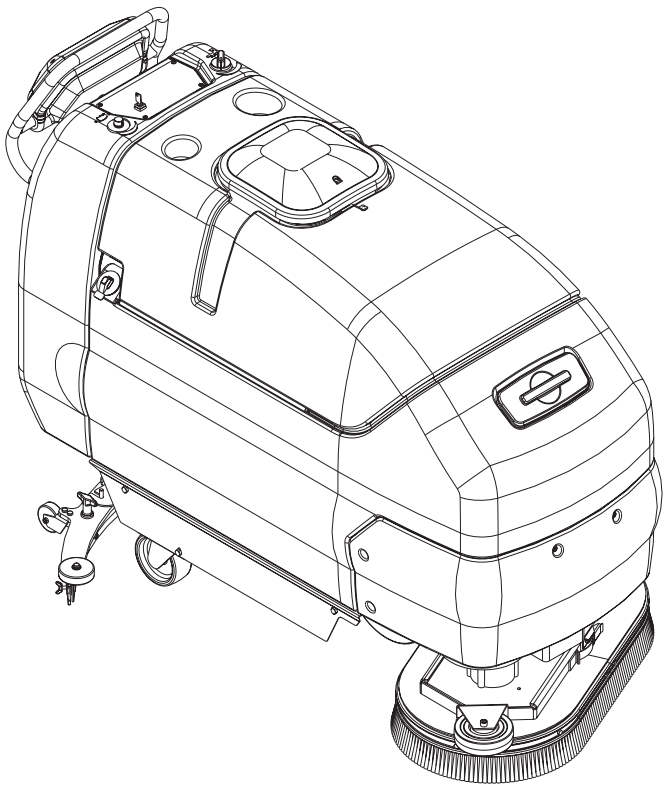
CMAX™ 28/34ST
I-MAX™ 28/32C
BA 750/850ST, BA 750C



SERVICE MANUAL
Advance MODELS 56396010, 56397403, 56397400, 56397401
Nilfisk MODELS 56396011, 56396012, 56397402

Nilfisk Advance
setting standards

6/02 revised 12/04 Form Number 56043071

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Note: All references to right, left, front, or rear in this manual are as seen from the operator's stand-point.

GENERAL INFORMATION

INTRODUCTION

This manual will help you get the most from your **CMAX™ 28/34ST, I-MAX™ 28/32C, BA 750/850ST & BA 750C**. Read it thoroughly before servicing the machine.

Note: Bold numbers and letters in parentheses indicate an item illustrated on pages 9-10.

PARTS AND SERVICE

Repairs, when required, should be performed by your Authorized Nilfisk-Advance Service Center, who employs factory trained service personnel, and maintains an inventory of Nilfisk-Advance original replacement parts and accessories.

Call the NILFISK-ADVANCE DEALER named below for repair parts or service. Please specify the Model and Serial Number when discussing your machine.

(Dealer, affix service sticker here.)

NAME PLATE

The Model Number and Serial Number of your machine are shown on the Nameplate on the machine. This information is needed when ordering repair parts for the machine. Use the space below to note the Model Number and Serial Number of your machine for future reference.

MODEL NUMBER _____

SERIAL NUMBER _____

TRANSPORTING THE MACHINE

⚠ CAUTION!

Before transporting the machine on an open truck or trailer, make sure that . . .

- The machine is tied down securely - see tie-down locations **(21)**.
- All access doors and covers are secured (tape and strap as needed).

TOWING

⚠ CAUTION!

If the machine must be towed or pushed, make sure the Master On/Off Key Switch **(B)** is in the OFF position and do not move the machine faster than a normal walking pace (2-3 mph, 3-5kph) and for short distances only. Note: Disconnecting the wheel drive motor wiring connector will make a disabled machine easier to push.

OTHER MANUALS AVAILABLE FOR YOUR MACHINE

The following manuals are available from the Nilfisk-Advance Literature Service Department (order according to model name and machine's serial number):

- I-MAX™ 28C, 32C / BA 750C / CMAX™ 34ST Parts List - Form Number 56042422
- CMAX™ 28ST / BA 750ST / BA 850ST Parts List - Form Number 56042423
- All Models covered in this manual Operation Manuals - Form Numbers
  56041518 (Danish, Norwegian, Swedish, Finnish)
  56041519 (English, German, French, Dutch)
  56041520 (Spanish, Portuguese, Italian, Greek)

CAUTIONS AND WARNINGS

SYMBOLS

Nilfisk-Advance uses the symbols below to signal potentially dangerous conditions. Read this information carefully and take the necessary steps to protect personnel and property.

⚠ DANGER!

Is used to warn of immediate hazards that will cause severe personal injury or death.

⚠ WARNING!

Is used to call attention to a situation that could cause severe personal injury.

⚠ CAUTION!

Is used to call attention to a situation that could cause minor personal injury or damage to the machine or other property.

GENERAL SAFETY INSTRUCTIONS

Specific Cautions and Warnings are included to warn you of potential danger of machine damage or bodily harm.

⚠ WARNING!

- This machine should only be used by properly trained and authorized persons.
- Keep sparks, flame and smoking materials away from batteries. Explosive gases are vented during normal operation.
- Charging the batteries produces highly explosive hydrogen gas. Charge batteries only in well-ventilated areas, away from open flame. Do not smoke while charging the batteries.
- Remove all jewelry when working near electrical components.
- Turn the key switch off (O) and disconnect the batteries before servicing electrical components.
- Never work under a machine without safety blocks or stands to support the machine.
- Do not dispense flammable cleaning agents, operate the machine on or near these agents, or operate in areas where flammable liquids exist.
- Do not clean this machine with a pressure washer.
- Do not operate this machine on ramps or inclines of more than a 2 degree angle.

⚠ CAUTION!

- This machine is not approved for use on public paths or roads.
- This machine is not suitable for picking up hazardous dust.
- Use care when using scarifier discs and grinding stones. Nilfisk-Advance will not be held responsible for any damage to floor surfaces caused by scarifiers or grinding stones.
- When operating this machine, ensure that third parties, particularly children, are not endangered.
- Before performing any service function, carefully read all instructions pertaining to that function.
- Do not leave the machine unattended without first turning the key switch off (O), removing the key and securing the machine's parking brake (if equipped).
- Turn the key switch off (O) before changing the brushes and before opening any access panels.
- Take precautions to prevent hair, jewelry, or loose clothing from becoming caught in moving parts.
- Use caution when moving this machine in below freezing temperature conditions. Any water in the solution or recovery tanks or in the hose lines could freeze.
- The batteries must be removed from the machine before the machine is scrapped. The disposal of the batteries should be safely done in accordance with your local environmental regulations.

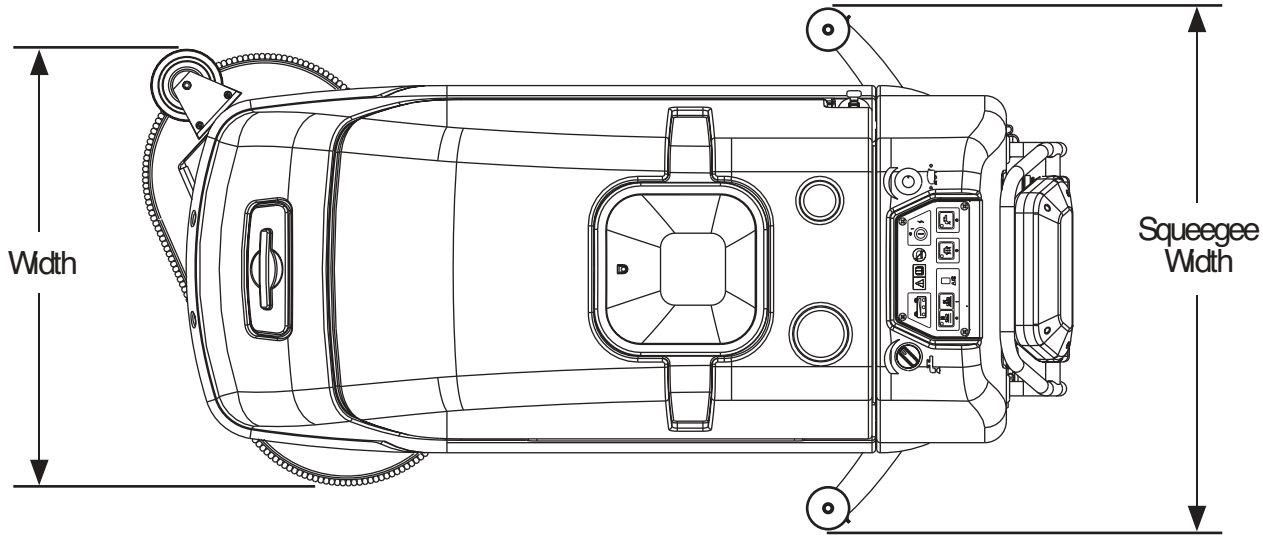
SAVE THESE INSTRUCTIONS

SPECIFICATIONS

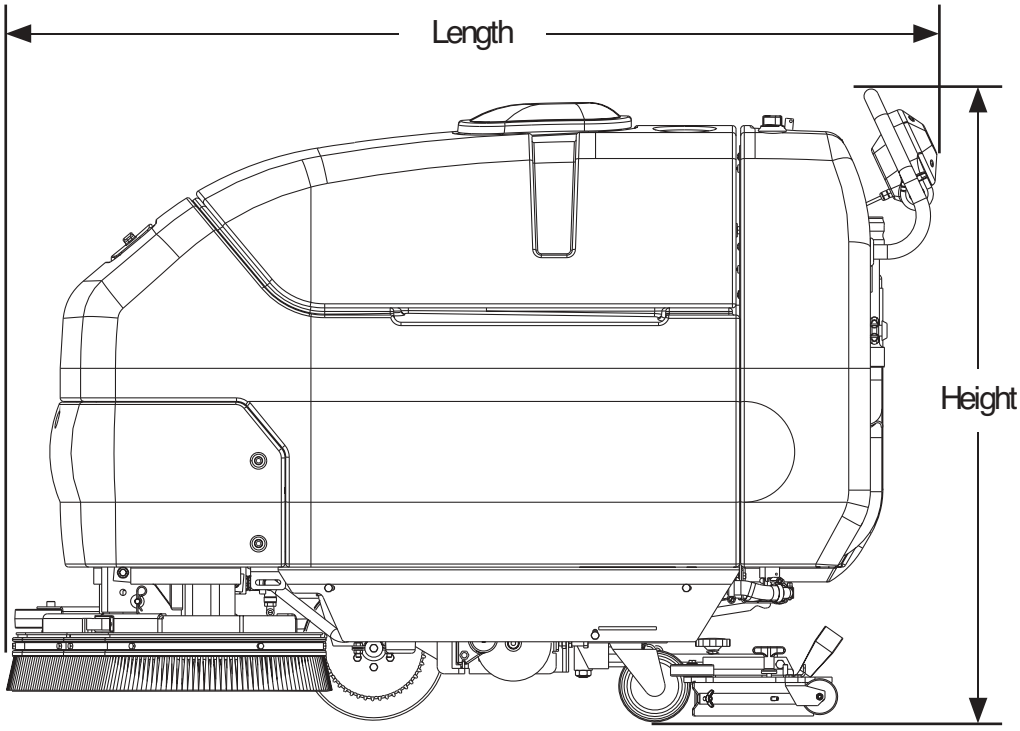
Model designation: (**A**)=CMAX 28ST & BA 750ST, (**B**)=BA 850ST, (**C**)=I-MAX 28C & BA 750C, (**D**)=I-MAX 32C, (**E**)=CMAX 34ST

General Specifications	**A**	**B**	**C**	**D**	**E**
	24V (disc)	24V (disc)	36V (cylindrical)	36V (cylindrical)	36V (disc)
Machine Length (English)	64 in.	65 in.	67.5 in.	67.5 in.	67.5 in.
Metric	163cm	165cm	172cm	172cm	172cm
Machine Width with Squeegee (English)	36.25 in.	45 in.	36.25 in.	45 in.	45 in.
Metric	92cm	114cm	92cm	114cm	114cm
Machine Width w/out Squeegee (English)	30 in.	35.5 in.	31 in.	35 in.	35.5 in.
Metric	76cm	90cm	79cm	89cm	90cm
Machine Height	44 in. (112cm)	44 in. (112cm)	44 in. (112cm)	44 in. (112cm)	44 in. (112cm)
Machine Net Weight* (English)	495 lbs.	535 lbs.	535 lbs.	619 lbs.	579 lbs.
Metric	225kg	243kg	243kg	281kg	263kg
Machine Gross Weight** (English)	1,100 lbs.	1,120 lbs.	1,350 lbs.	1,350 lbs.	1,350 lbs.
Metric	499kg	508kg	612kg	612kg	612kg
Cleaning Width (scrubbing path) (English)	28 in.	33.5 in.	28 in.	32 in.	33.5 in.
Metric	71cm	85cm	71cm	81cm	85cm
Coverage Rate Per Hour (theory) (English)	37,100 ft^2	44,388 ft^2	37,100 ft^2	46,200 ft^2	44,388 ft^2
Metric	3,447m^2	4,124m^2	3,447m^2	4,292m^2	4,124m^2
Brush Diameter (qty of 2)	14 in. (36cm)	17 in. (43cm)	5.75 in. (15cm)	5.75 in. (15cm)	17 in. (43cm)
Brush Core Length (qty of 2) (Cylindrical)	–	–	27 in. (69cm)	31 in. (79cm)	–
Brush Speed (RPM)	220	220	900	900	220
Brush Pressure Variable, (English)	25-250 lbs.	25-300 lbs.	25-250 lbs.	25-250 lbs.	25-300 lbs.
Metric	11-113kg	11-136kg	11-113kg	11-113kg	11-136kg
Solution Tank Capacity	24 gal. (91l.)	24 gal. (91l.)	30 gal. (114l.)	30 gal. (114l.)	30 gal. (114l.)
Recovery Tank Capacity	24 gal. (91l.)	24 gal. (91l.)	30 gal. (114l.)	30 gal. (114l.)	30 gal. (114l.)
Vacuum Water Lift (Sealed)	56 in.	56 in.	68 in.	68 in.	68 in.
(Open Hole Adapter 1")	9 in.	9 in.	13 in.	13 in.	13 in.
Sound pressure level as per ISO 3744 (at operator)	70 dB(A)	70 dB(A)	70 dB(A)	70 dB(A)	70 dB(A)
Transport Speed (**Fwd.** Maximum)	265 FPM	265 FPM	265 FPM	265 FPM	265 FPM
Metric	81 m/min	81 m/min	81 m/min	81 m/min	81 m/min
Transport Speed (**Rev.** Maximum)	140 FPM	140 FPM	140 FPM	140 FPM	140 FPM
Metric	43 m/min	43 m/min	43 m/min	43 m/min	43 m/min
Power Source (Batteries) STD	(**4**) 6V/238AH	(**4**) 6V/238AH	(**6**) 6V/238AH	(**6**) 6V/238AH	(**6**) 6V/238AH
Battery Weight (each)	66lbs. (29.9kg)	66lbs. (29.9kg)	66lbs. (29.9kg)	66lbs. (29.9kg)	66lbs. (29.9kg)
Battery Compartment Size					
Height (Max.)	13 in. (33cm)	13 in. (33cm)	15 in. (38cm)	15 in. (38cm)	15 in. (38cm)
Width (Max.)	15 in. (38cm)	15 in. (38cm)	21.37 in. (54cm)	21.37 in. (54cm)	21.37 in. (54cm)
Length (Max.)	24 in. (61cm)	24 in. (61cm)	23.5 in. (59cm)	23.5 in. (59cm)	23.5 in. (59cm)
Battery Chargers – see Electrical System Battery Section					
Wheel Drive Motor***	.5 hp, 552 watt	.5 hp, 552 watt	.5 hp, 540 watt	.5 hp, 540 watt	.5 hp, 540 watt
Vacuum Motor	.75 hp, 570 watt	.75 hp, 570 watt	.75 hp, 570 watt	.75 hp, 570 watt	.75 hp, 570 watt
Brush Drive Motors*** (2 each)	.75 hp, 792 watt	.75 hp, 792 watt	.75 hp, 684 watt	.75 hp, 684 watt	.75 hp, 792 watt
Machine Current (Average)	75 Amps	90 Amps	90 Amps	90 Amps	90 Amps

***Net Weight:** Standard machine without options, empty solution and recovery tanks, without removable scrub brushes and no batteries installed.
****Gross Weight:** Standard machine without options, full solution tank and empty recovery tank, with removable scrub brushes and 305 AH batteries.
***Listings for watts are maximum values.



TOP VIEW



SIDE VIEW

MAINTENANCE

MAINTENANCE SCHEDULE

Maintenance intervals given are for average operating conditions. Machines used in severe operational environments may require service more often.

MAINTENANCE ITEM	Daily	Weekly	Monthly	Yearly
Charge the Batteries	X			
Drain / Clean and Check Tanks & Hoses	X			
Check / Clean / Rotate the Brushes/Pads	X			
Check / Clean / Adjust the Squeegee	X	X		
Check / Clean Vacuum Shut-Off Float	X			
Clean Hopper on Cylindrical System	X			
Check Each Battery Cell's Water Level		X		
Inspect and Clean Solution Filter		X		
Check Parking Brake (option) For Wear & Adjustment		X		
Clean Solution Trough on Cylindrical System		X		
Lubricate the Machine			X	
*Check Motor(s) Carbon Brushes				X

Note: See the individual machine system sections for maintenance information.

⚠ WARNING!

Turn the key switch off and disconnect the batteries before servicing the machine.

* Check vacuum motor carbon brushes (Qty 2) once a year or after 300 operating hours.
* Check brush and wheel drive motor(s) carbon brushes (Qty 4 per motor) once a year or after 500 operating hours.
* The original (new) length of each carbon brush is 1" (25.4mm) on all machine models 24 volt and 36 volt brush and wheel drive motors.
* All motors: Replace carbon brushes when shorter than 3/8" (9.5mm) to obtain the same motor efficiency as new brushes.

⚠ IMPORTANT!

Motor damage resulting from failure to service the carbon brushes is not covered under warranty. See the Limited Warranty Statement.

BATTERIES AND CHARGERS

Attention: See the electrical system manual section for battery installation, battery maintenance and charger system requirements.

LUBRICATING THE MACHINE

Once a month, pump a small amount of grease into each grease fitting on the machine until grease seeps out around the bearings.

Grease fitting locations are:

- Rear Caster Wheel Swivel and Axle 2 per wheel (4) total.

Once a month, apply light machine oil to lubricate the:

- Drive Chain
- Pivot Points For the Squeegee & Scrub Brush Linkage

Nilfisk BA 750/850ST Models 56396011, 56396012
Advance CMAX™ 28/34ST Models 56396010, 56397403
PM Checklist

Customer _____

Address _____

City _____ **St** _____ **Zip** _____

Model _____ **Serial** _____ **Hours** _____

Defect Codes
- **A** needs adjustment
- **B** binding
- **C** dirty or contaminated
- **D** damaged, bent or torn
- **L** leaks
- **M** missing
- **W** worn out

Ref	OPERATIONAL INSPECTION ITEMS	OK	Defect Codes (circle)	Does Not Work
1	Drive Paddle Operation (check for Fwd/Rev Drive & any neutral creep)		A B D	
2	Drive System Performance (Speed Changes Min/Max)		noisy sluggish	
3	Scrub System (Raise/Lower, Brush Motor On/Off & Optional Brush Remove Feature)		A B D	
4	Scrub Brush Pressure settings (1-9)		A B	
5	Squeegee System (Raise/Lower & Squeegee Tool pickup Performance)		A B D	
6	Vac Performance (Sealed water lift & 1" open hole adapter, 24v-56/9 & 36v -68/13)		C L W	
7	Solution Control (On/Off Manual /Auto and Flow Volume Min/Max)		A B L	
8	Battery Charger (Auto turn ON & OFF)		D	
9	Main Controller Special Program Options (see SVR manual 56043071). Check all applicable machine settings. Examples: Scrub mode pressure settings, diagnostic troubleshooting SVR test mode, low voltage cutout etc.		A	

Ref	VISUAL INSPECTION ITEMS	Comments	OK	Defect Codes (circle)	Does Not Work
10	Scrub Brushes, check for wear and rotate			D M W	
11	Scrub Brush Motor(s), check for carbon brush wear	500 Hours		B C W	
12	Scrub Brush Motor(s), check gearboxes			B D L	
13	Brush Drive Plate Retainer Clips & flex couplers			C D M	
14	Scrub Deck Skirts and Side Wheels			D M W	
15	Solution Solenoid Valve			C D L W	
16	Solution Flow Control Valve and Linkage			A B D W	
17	Solution Tank, Delivery Hoses & Filter	Clean filter screen		C L	
18	Vacuum Motor Carbon Brushes (wear limit 3/8")	300 Hours		B C W	
19	Vacuum Float Ball & Cage Assembly	Clean float		C D M	
20	Recovery Tank Cover Gasket			L M W	
21	Recovery Tank Drain Hose & Cap			C D L	
22	Squeegee Pick-Up Hose	Back flush		C D L	
23	Squeegee Tool & Blades (clean, rotate & adjust)			A D W	
24	Squeegee Tool Wheels (lubricate)	Two side and two floor		A D W	
25	Battery Condition (load test, clean & water)			C W	
26	Front Drive Wheel Motor Check Carbon Brushes	500 Hours		B C W	
27	Front Drive Tire	tread wear		W	
28	Drive wheel Motor Chain (Lubricate and tension)			A B C W	
29	Rear chassis Caster Wheels (Lubricate)	tread wear		W	

NOTE: For additional service information see service manual form number 56043071and operators manual form numbers 56041518, 56041519 & 56041520.

WORK COMPLETED BY: ACKNOWLEDGED BY:

_____ _____ _____ _____

Service Technician Signature Date Customer Signature Date

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Nilfisk BA 750C Model 56397402
Advance I-MAX™ 28/32C Models 56397400, 56397401
PM Checklist

Customer _____

Address _____

City _____ **St** _____ **Zip** _____

Model _____ **Serial** _____ **Hours** _____

Defect Codes
- **A** needs adjustment
- **B** binding
- **C** dirty or contaminated
- **D** damaged, bent or torn
- **L** leaks
- **M** missing
- **W** worn out

Ref	OPERATIONAL INSPECTION ITEMS	OK	Defect Codes (circle)	Does Not Work
1	Drive Paddle Operation (check for Fwd/Rev Drive & any neutral creep)		A B D	
2	Drive System Performance (Speed Changes Min/Max)		noisy sluggish	
3	Scrub System (Raise/Lower, Brush Motor On/Off & Optional Brush Remove Feature)		A B D	
4	Scrub Brush Pressure settings (1-9)		A B	
5	Squeegee System (Raise/Lower & Squeegee Tool pickup Performance)		A B D	
6	Vac Performance (Sealed water lift & 1" open hole adapter, 24v-56/9 & 36v -68/13)		C L W	
7	Solution Control (On/Off Manual /Auto and Flow Volume Min/Max)		A B L	
8	Battery Charger (Auto turn ON & OFF)		D	
9	Main Controller Special Program Options (see SVR manual 56043071). Check all applicable machine settings. Examples: Scrub mode pressure settings, diagnostic troubleshooting SVR test mode, low voltage cutout etc.		A	

Ref	VISUAL INSPECTION ITEMS	Comments	OK	Defect Codes (circle)	Does Not Work
10	Scrub Brushes, check for wear and rotate	Cylindrical brushes		D M W	
11	Scrub Brush Motor(s), check for carbon brush wear	500 Hours		B C W	
12	Scrub Brush Motor(s), check drive belts & idler assy's			A B D	
13	Scrub Deck, clean debris hopper			C D M	
14	Scrub Deck Skirts and Side Wheels			D M W	
15	Solution Solenoid Valve			C D L W	
16	Solution Flow Control Valve and Linkage			A B D W	
17	Solution Tank, Delivery Hoses & Filter	Clean filter screen		C L	
18	Vacuum Motor Carbon Brushes (wear limit 3/8")	300 Hours		B C W	
19	Vacuum Float Ball & Cage Assembly	Clean float		C D M	
20	Recovery Tank Cover Gasket			L M W	
21	Recovery Tank Drain Hose & Cap			C D L	
22	Squeegee Pick-Up Hose	Back flush		C D L	
23	Squeegee Tool & Blades (clean, rotate & adjust)			A D W	
24	Squeegee Tool Wheels (lubricate)	Two side and two floor		A D W	
25	Battery Condition (load test, clean & water)			C W	
26	Front Drive Wheel Motor Check Carbon Brushes	500 Hours		B C W	
27	Front Drive Tire	tread wear		W	
28	Drive wheel Motor Chain (Lubricate and tension)			A B C W	
29	Rear chassis Caster Wheels (Lubricate)	tread wear		W	

NOTE: For additional service information see service manual form number 56043071and operators manual form numbers 56041518, 56041519 & 56041520.

WORK COMPLETED BY: ACKNOWLEDGED BY:

Service Technician Signature _____ Date _____ Customer Signature _____ Date _____

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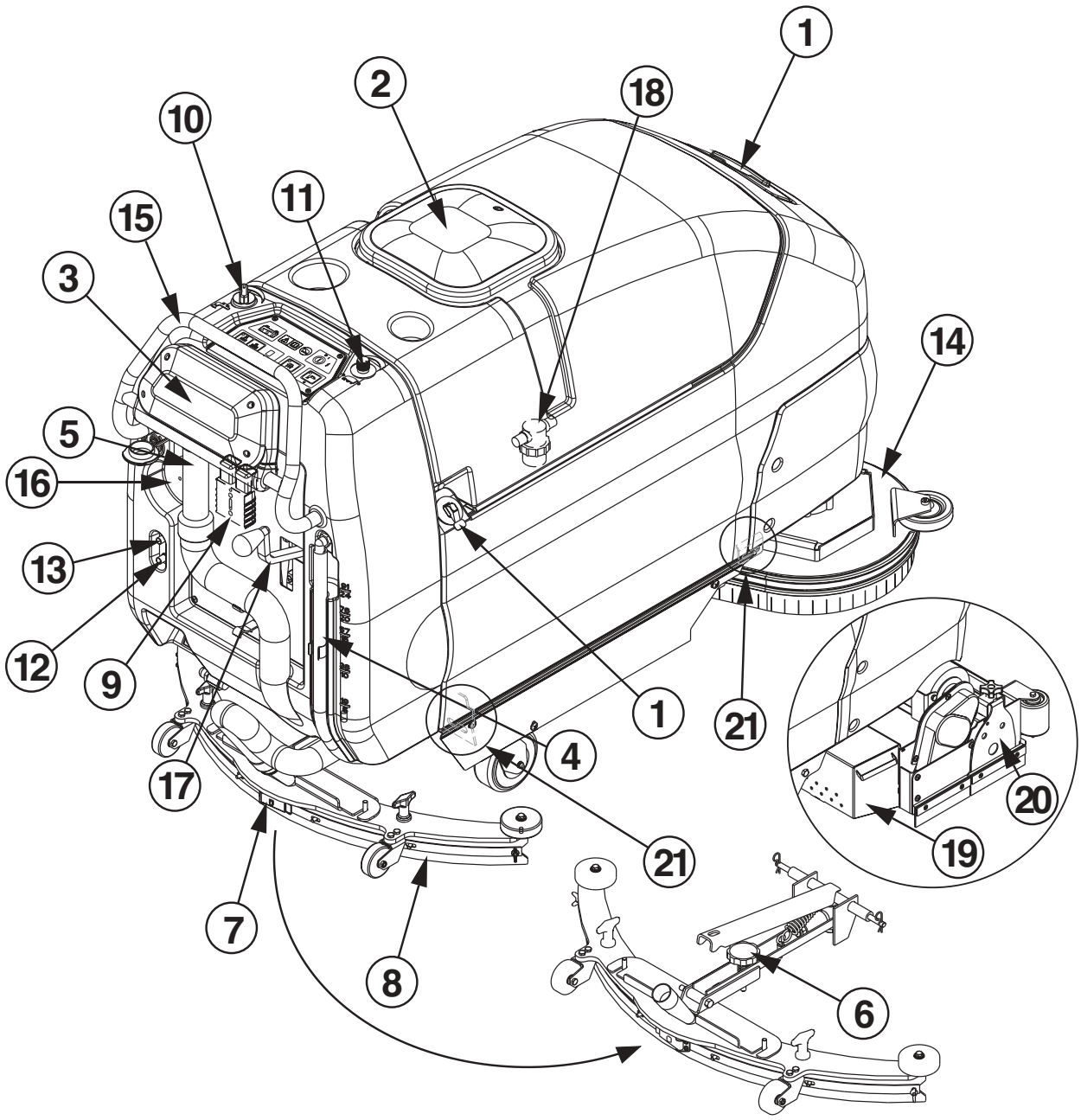
5/06/02

KNOW YOUR MACHINE

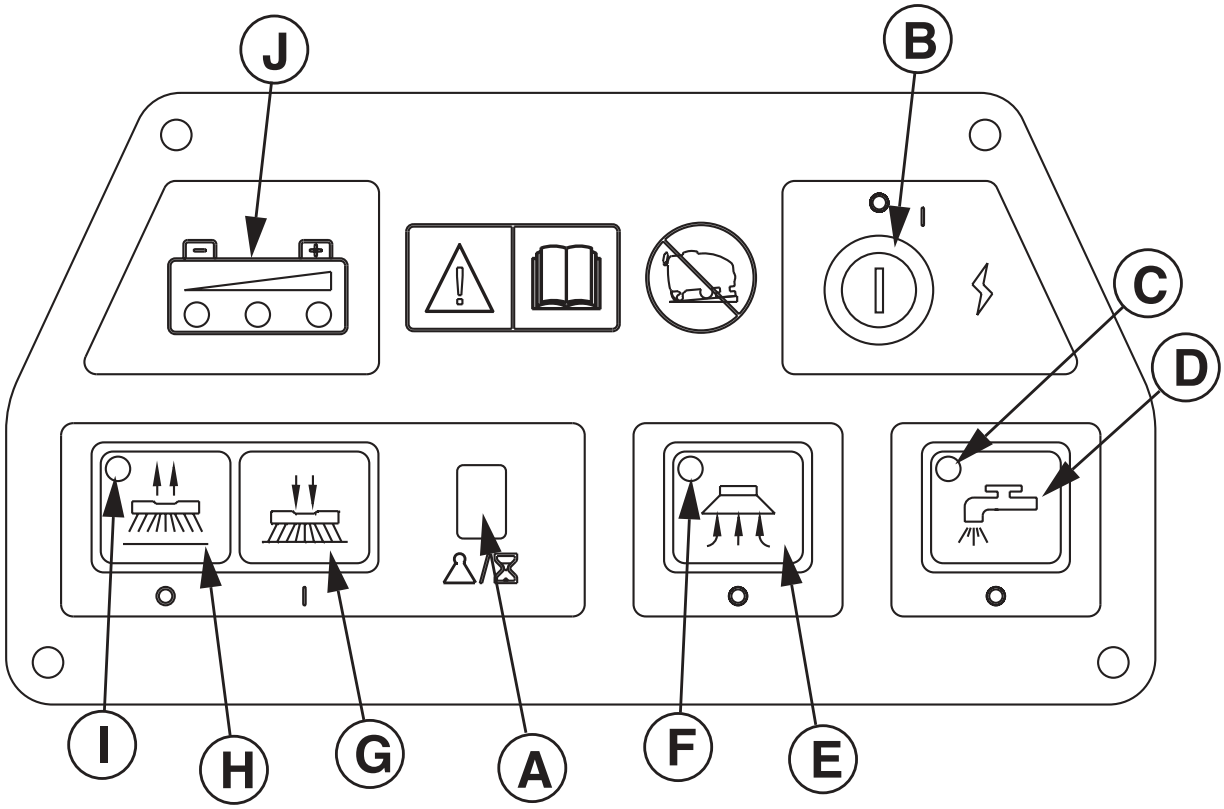
1 Solution Tank Fill
2 Recovery Tank Cover
3 Drive Paddle
4 Solution Drain Hose / Level Indicator
5 Recovery Drain Hose
6 Squeegee Adjustment Bolt
7 Squeegee Blade Latch
8 Squeegee
9 Machine Battery Connector
10 Solution Flow Control Knob
11 Speed Limit Control Knob
12 Wheel Drive Circuit Breaker (30 Amp)
13 Control Circuit Circuit Breaker (5 Amp)
14 Brush Deck
15 Operator Control Handle
16 Operator Hand Brake (optional)
17 Squeegee Lever
18 Solution Filter
19 Hopper (Cylindrical Only)
20 Idler Assembly (Cylindrical Only)
21 Tie Down Locations (4)



KNOW YOUR MACHINE

CONTROL PANEL

A Scrub Pressure/Hourmeter Display
B Master On/Off Key Switch
C Solution System Indicator
D Solution Button
E Vacuum Button
F Vacuum System Indicator
G Scrub ON / Pressure Increase Button
H Scrub OFF / Pressure Decrease Button
I Scrub OFF Indicator
J Battery Condition Indicator



FUNCTIONAL DESCRIPTION OF CONTROLS:

Solution Tank Fill (1) – Open to fill the solution tank, use non-foaming chemicals only.
Recovery Tank Cover (2) – Point of entry for waste water into tank. Also houses float ball which shuts off vacuum port to vac motor when tank is full.
Drive Paddle (3) – Located on top at the rear of the machine, the operator can make the machine go forward by pushing forward on it, or reverse by pulling backward on it. The speed is variable depending on how far forward or backward the paddle is moved. When the brush head is in the "DOWN" position, the brushes and solution will operate when the drive is engaged in either direction, but will stop after the machine is stationary for 3 seconds.
Solution Drain Hose / Level Indicator (4) – Used to empty the solution tank and show current level of solution in tank, graduations are marked on the side of the solution tank next to the hose.
Recovery Drain Hose (5) – Used to empty the recovery tank.
Squeegee Adjustment Bolt (6) – Used to adjust the tilt of the squeegee. Turn bolt clockwise to tilt the squeegee backwards and counter-clockwise to tilt it forward.
Squeegee Blade Latch (7) – Holds rear squeegee blade and straps in place, release to replace rear blade.
Squeegee (8) – Picks up solution after scrubbing.
Machine Battery Connector (9) – Batteries plug into this connector, disconnect to charge batteries.
Solution Flow Control Knob (10) – Turn this dial to the right to decrease solution flow to the floor. Turn to the left, to increase the amount of solution flow to the floor. When the Drive Paddle **(3)** is released from either forward or reverse travel, the solution flow will stop automatically, and resume when the drive is engaged.
Speed Limit Control Knob (11) – The Speed Limit Control Knob is used to adjust the maximum speed in both forward or reverse.
Wheel Drive Circuit Breaker (12) – Provides overload protection to machine's wheel drive motor. If it trips, it will pop out. To reset, wait one minute and press the button back in. If any breaker trips repeatedly, have the machine serviced.
Control Circuit Circuit Breaker (13) – Provides overload protection. If it trips, it will pop out. To reset, wait one minute and press the button back in. If any breaker trips repeatedly, have the machine serviced.
Brush Deck (14) – Contains brush drive motors and brushes.
Operator Control Handle (15) – Operator holds onto this to control the machine.
Operator Hand Brake (optional) (16) – Use to prevent machine from rolling.
Squeegee Lever (17) – This lever is used to lower or raise the squeegee assembly.
Solution Filter (18) – Filters solution prior to dispensing on floor.
Hopper (19) – Found only on cylindrical models, catches debris.
Idler Assembly (20) – Found only on cylindrical models, remove this to access broom on each side.

FUNCTIONAL DESCRIPTION OF CONTROL BUTTONS:

The controls were designed with one touch operation in mind. For single pass scrubbing the user can simply depress one button and all systems on the machine will be ready to go.

For most single-pass scrubbing operations, the operator should only need to use the left-hand two buttons on the control panel. These are the Scrub OFF and Scrub ON buttons. For this reason these buttons are outlined in bright white on the control panel while the other buttons are outlined in gray.

Solution Button (D) - This button is used to select the mode of operation for the solution system. There are 3 modes of operation for this system. The modes are OFF, AUTO, MOMENTARY ON. Following is a description of each mode and how they are selected.
OFF MODE: In this mode the solution flow is turned off. As mentioned in the following, when the scrub ON button **(G)** is pushed, the solution system will be placed in the AUTO mode. If it is desired to scrub without dispensing solution, the solution can be turned off by pressing this button at any time.
AUTO MODE: This mode is automatically selected when the scrub ON button **(G)** is pushed. In this mode the solution flow will be turned on whenever forward or reverse direction is selected via the Drive Paddle **(3)**. The solution flow will be turned off otherwise.
MOMENTARY ON MODE: This mode can only be selected when the scrub mode is OFF. Solution can be dispensed by pressing and holding the solution button. Solution will be dispensed for as long as the button is held. This is for pre-wetting the floor prior to scrubbing.

KNOW YOUR MACHINE

Vacuum Button (E) - This button is used to select the mode of operation for the vacuum system. There are 3 modes of operation for this system. These modes are OFF, AUTO, ON. Following is a description of each mode and how they are selected.

OFF MODE: In this mode the vacuum is off. As mentioned in the following, when the scrub ON button **(G)** is pushed, the vacuum system will be placed in the AUTO mode. If it is desired to double-scrub (scrub without recovering the solution) the vacuum system can be turned off by pressing this button at any time.

AUTO MODE: This mode is automatically selected when the scrub ON button **(G)** is pushed. The vacuum will turn on when the drive paddle **(3)** is moved forward or reverse. Once the scrub system has been turned OFF, the vacuum will remain ON. To turn the vacuum OFF, press and release the vacuum button or the scrub OFF button **(H)**. This will start a ten second delay to allow pick-up of remaining solution. This mode can be selected independently of the scrub mode by pressing and releasing the vacuum button.

ON MODE: In this mode the vacuum will be on regardless of the drive paddle **(3)** position. This mode is selected by pressing and holding the Vacuum Button **(E)** for approximately 1.5 seconds. The vacuum mode must first be OFF before entering this mode. This mode is included in the event an external wand is to be used with this machine or if the operator wants to clean the squeegee using the vacuum hose.

Scrub ON / Pressure Increase Button (G) - Pressing the scrub ON button will enable the scrub system and set the scrub pressure to the last selected value. The status display **(A)** will display the scrub pressure setting. This is indicated by a number. Subsequent presses of the scrub ON button will step the pad pressure setting through the allowable range up to the maximum value of 9. The following will occur when this button is pressed:

- The scrub deck will be lowered
- The vacuum and solution systems will be enabled (vacuum and solution modes = AUTO)
- As soon as a direction is commanded by the Drive Paddle **(3)** (forward or reverse) the brushes will start turning and the vacuum and solution will turn on.

Scrub OFF / Pressure Decrease Button (H) - Momentarily pressing this button will step the pad pressure down to a minimum value of 1. Pressing and holding this button for approximately 1/2 second when the unit is in scrub mode will cause the following to occur:

- The status display **(A)** will indicate "0"
- The scrub brushes will turn off
- The scrub deck will raise to the UP position
- The solution flow will be stopped and the last used pad pressure will be saved
- The first time that this button is pressed, the vacuum system will NOT be turned off. This is so that any remaining water may be picked up without having to turn the vacuum back on. If this button is pressed a second time (pressed after the scrub mode has been turned off) the vacuum will shut off after a 10 second delay.

NOTE: Reducing the pad pressure to "1" and then pressing this button one more time will also turn the scrub system OFF. In this case the last used pressure will not be saved.

NOTE: If the optional Brush Remove Feature is installed, it functions as follows:

- To activate the automatic brush removal feature, the scrub deck must be in the UP position and the Drive paddle must be in neutral.
- Press and hold the Scrub OFF / Pressure Decrease Button **(H)** for 1 second. The Scrub OFF Indicator **(I)** will turn RED and the brush motors will turn on briefly. The motors will then stop abruptly which will cause the brushes to fall off.

DESCRIPTION OF INDICATORS ON THE CONTROL PANEL:

In general, the following guidelines apply to the control panel indicators:

A steady red indicator means that the function is inhibited for some reason.

A flashing red or yellow indicator means that a fault has occurred in the particular system. An example of this would be an over-current fault.

A yellow indicator means that the particular function has been enabled but is not currently on. For example, if the scrub system is activated and the Drive Paddle **(3)** is in neutral, the vacuum and solution indicators will all be yellow indicating that the systems are enabled and ready to turn on when the Drive Paddle **(3)** is moved to forward or reverse.

A green indicator means that the particular system is on.

A flashing green indicator means that the particular system is in a delayed-off condition. An example of this is when the scrub system is activated and the Drive Paddle **(3)** goes from forward or reverse to neutral. When this happens the vacuum indicator will flash green indicating that the vacuum is still on but that it will be turning off after the delay period.

Scrub Pressure/Hourmeter Display (A):

- The scrub pressure/hourmeter display will scroll the hourmeter information only if all of the systems are turned off and the throttle has been in neutral for at least ten seconds. The hourmeter information will also be displayed immediately once the key switch has been turned on.
- If any of the systems are turned on or the throttle is in forward or reverse, the display will show the relative scrub pressure value (1-9) or 0 if the scrub system is off. This value is a relative indication of scrubbing effort. It is not an absolute indication of the scrub pressure.

Solution System Indicator (C):

- This indicator will be green if the solution is on.
- This indicator will be yellow if the solution is enabled but not turned on.
- This indicator will be off if the solution is disabled and turned off.

DESCRIPTION OF INDICATORS ON THE CONTROL PANEL: (CONTINUED)

Vacuum System Indicator (F):

- This indicator will be green if the vacuum is on.
- This indicator will flash green at a slow rate if the ten second delayed turn-off timer is running.
- This indicator will be yellow if the vacuum is enabled but not turned on.
- This indicator will flash yellow at a fast rate if there is an overload of the vacuum motor.
- This indicator will be off if the vacuum is disabled and turned off.

Scrub OFF Indicator (I):

- This indicator will be green if the scrub system is ready to be turned on.
- This indicator will be red if for any reason the scrub system cannot be turned on.
- This indicator will flash red at a fast rate if there is an overload of the brush motors or the brush lift actuator motor.
- This indicator will be off if the scrub system has been activated.

Recovery Tank FULL Indication:

- If the recovery tank reaches the full level, the float ball will plug the vacuum inlet which will cause the control system to shut off the scrub, vacuum, and solution systems. The hour meter/status display (A) will scroll the word “FULL” to indicate that the tank is full.
- Pressing the scrub-off/pressure-decrease, scrub-on/pressure-increase, or vacuum buttons will clear the full indication.
- The automatic vacuum shutoff feature can be disabled if the vacuum shuts off even when the tank is not full. Refer to the Electrical System Main Control Board Special Program Options to disable.

System Overload Indications:

- If the scrub motors or the scrub deck lift actuator become overloaded, the scrub and solution systems will turn off and the scrub-off/pressure-decrease indicator will flash red at a fast rate (four times per second).
- If the vacuum motor becomes overloaded, the scrub, vacuum, and solution systems will turn off and the vacuum indicator will flash yellow at a fast rate (four times per second).
- To reset an overload condition, turn the key switch off and then back on.

DESCRIPTION OF THE BATTERY CONDITION INDICATOR

Attention: See the Electrical System manual section for the explanation of the battery condition indicator lights.

DESCRIPTION OF THE HOURMETER/STATUS DISPLAY

The single character (LED) display **(A)** located in the middle of the control panel is primarily used to present the accumulative machine hours of operation and the working brush pressure setting. The display is also used to present additional machine information depending upon selecting (entering) special controller program modes. Listed below are some the special program modes.

- Scrub pressure adjustment limits (1-9)
- Battery low voltage cutout threshold selection
- Main control board software revision level
- Scrub brush type motor selection
- Recovery tank FULL indicator selection
- Brush remove option selection
- Service test mode troubleshooting diagnostics

NOTE: Reference in the Electrical System manual section the instructions for programming the special controller options.

SOLUTION SYSTEM

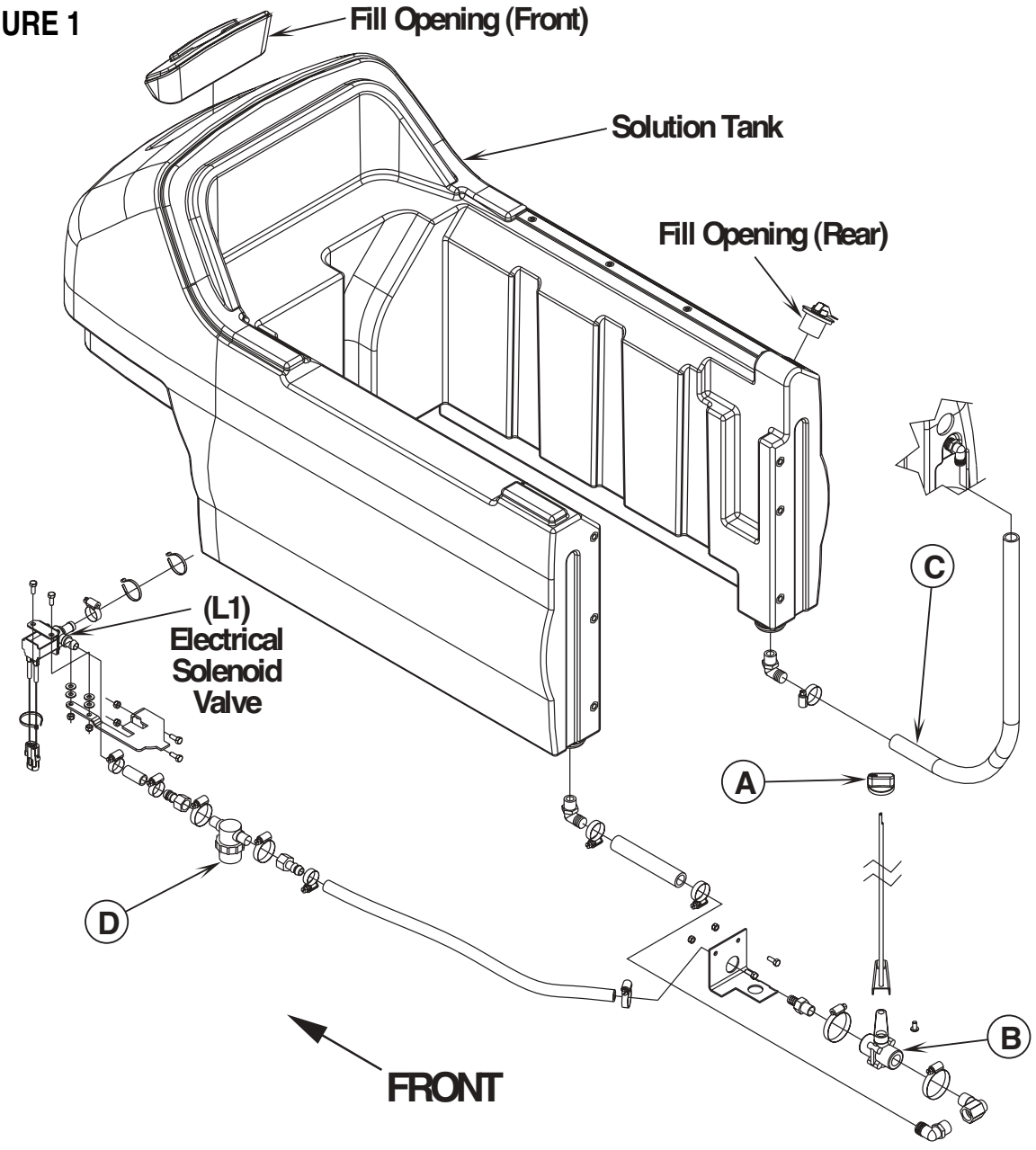
FUNCTIONAL OVERVIEW

The CMAX™ 28ST, BA 750ST and BA 850ST models have a solution tank fill capacity of 24-gallons (90 liters). The I-MAX™ 28C/32C, BA 750C and CMAX™ 34ST models tank capacities are 30-gallons (114 liters). All models use two tank fill openings one located in the front and another in the rear, which offers ease of filling. Plumbed into the main solution control valve hose outlet is a serviceable solution filter, to keep debris from entering the solenoid valve. Also fitted to the tank is a flexible hose used to indicate the solution level and to drain the tank for system maintenance.

See Figure 1*. The solution system uses (2) valves to regulate the amount of solution dispensed onto the floor. The knob **(A)** located on the control panel operates the main solution valve **(B)** that controls the needed flow volume demand to the scrub brushes. The (L1) electrical solenoid valve stops and starts the solution flow to the scrub brushes see electrical diagram. The electrical circuit that turns on (energizes) the solenoid coil is activated through the (A1) control panel's solution switch button and the (A2) operation wheel drive controller assembly. Note: See the Know Your Machine section in this manual for a complete explanation of the solution operation modes.

During normal machine scrubbing the solution system's Auto Mode is selected and works in conjunction with the wheel drive speed controller and the (A1) main controller's scrub system outputs to turn On & Off the (L1) solenoid valve. The solution will flow to the scrub brushes when the main flow control valve is open, the scrub deck is lowered and the handle drive paddle (box) is pushed or pulled into Fwd or Rev. Note: When the solution On/Off button is turned Off, no flow can occur regardless of the manual flow control valve being On, drive control paddle activated and the scrub deck down.

FIGURE 1



*Note: Figure 1 shows the solution components of the CMAX™ 28ST, BA 750ST and BA 850ST. Similar components are found on the I-MAX™ 28C/32C, BA 750C and CMAX™ 34ST.

CIRCUIT OVERVIEW SOLUTION AUTO MODE

See Figure 2.

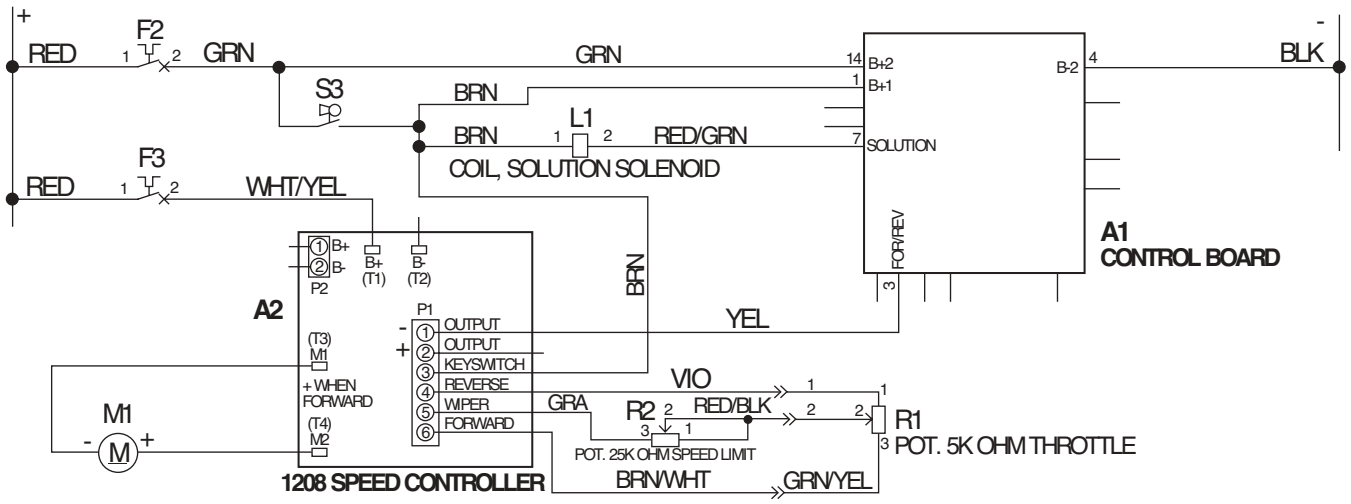
+ (Positive) circuit input starts with:

- A closed S3 key switch will direct the needed positive voltage (BRN wires) to the L1 solenoid coil and A1 control board terminal #1.

- (Negative) circuit input starts with:

- A battery negative ground input at the A1 control board terminal #4.
- The A1 control board solution button enabled.
- A negative voltage output from the A2 speed controller's P1 (pin #1) to the A1 control board yellow wire (terminal #3). Note: The A2 speed controls auxiliary output (pin #1) occurs whenever the R1 direction throttle pot is moved off its neutral setting.
- A negative voltage output from the A1 board's terminal #7 Red/Grn wire is direct to the L1 solenoid coil turning it on to allow flow through the valve body.

FIGURE 2



Electrical Diagram

*For complete description of all callouts see Electrical System Wiring Diagram.

SOLUTION SYSTEM

SOLUTION SYSTEM MAINTENANCE

• **Solution Tank:** See Figure 1. Weekly empty the solution tank; remove the solution Drain Hose **(C)** from its storage area (located on the right rear control handle compartment). Direct the hose to a designated "Disposal Site" and flush the tank with clean water.

• **Solution Filter:** Remove and clean the inline Solution Filter **(D)**. To access the filter housing for removal, work underneath the middle left side chassis panel. No tools are needed to remove the filter (hand tighten only). **Service Tip:** The manual solution control knob must be placed in the full OFF position. This prevents loss of solution when servicing the filter strainer with a partial or full tank.

• **Solution Delivery Trough:** On the cylindrical scrub deck clean the holes in the delivery trough to assure even distribution of solution.

TROUBLESHOOTING GUIDE

Problem	Possible Cause
Inadequate or no solution flow	No solution in the tank
	Main solution flow control valve knob is in the off position
	Clogged solution filter, valves and hoses
	Defective solution solenoid valve (L1)*
	Solution system fault in the main controller A1*

*Reference the Solution System Troubleshooting Guide flowchart in this manual section for further component diagnostics.

TROUBLESHOOTING GUIDE ELECTRICAL

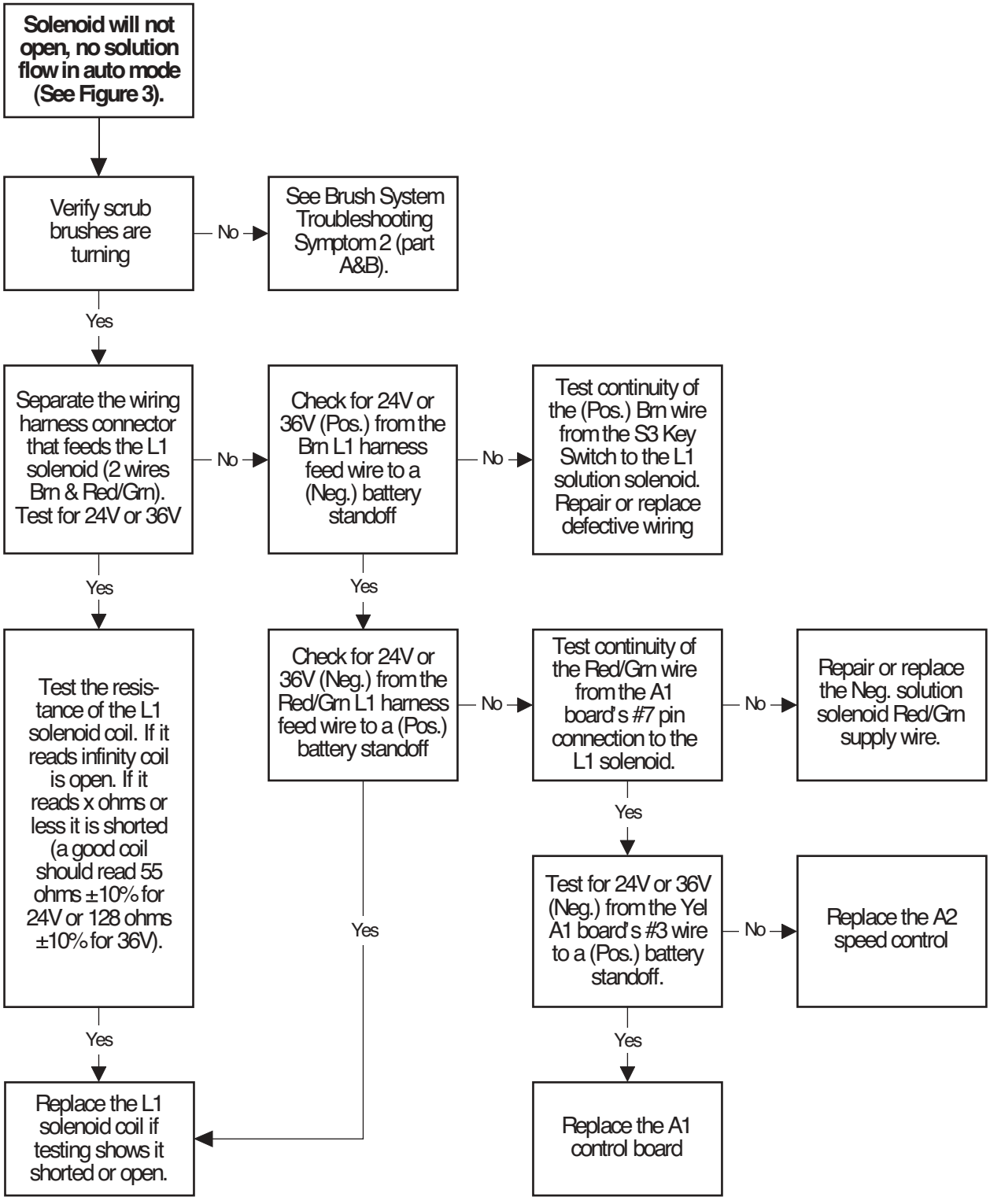
Possible Symptom

1 Solution solenoid valve will not open when in the scrub auto solution mode.

SYMPTOM ONE

Note: Do all testing with the key switch on, scrub deck lowered, solution button enabled and the drive paddle activated (pushed Fwd or pulled into Rev).

Note 2: Enter the Service Test Mode Program in the Electrical System manual section, for **alternate** machine troubleshooting procedures.

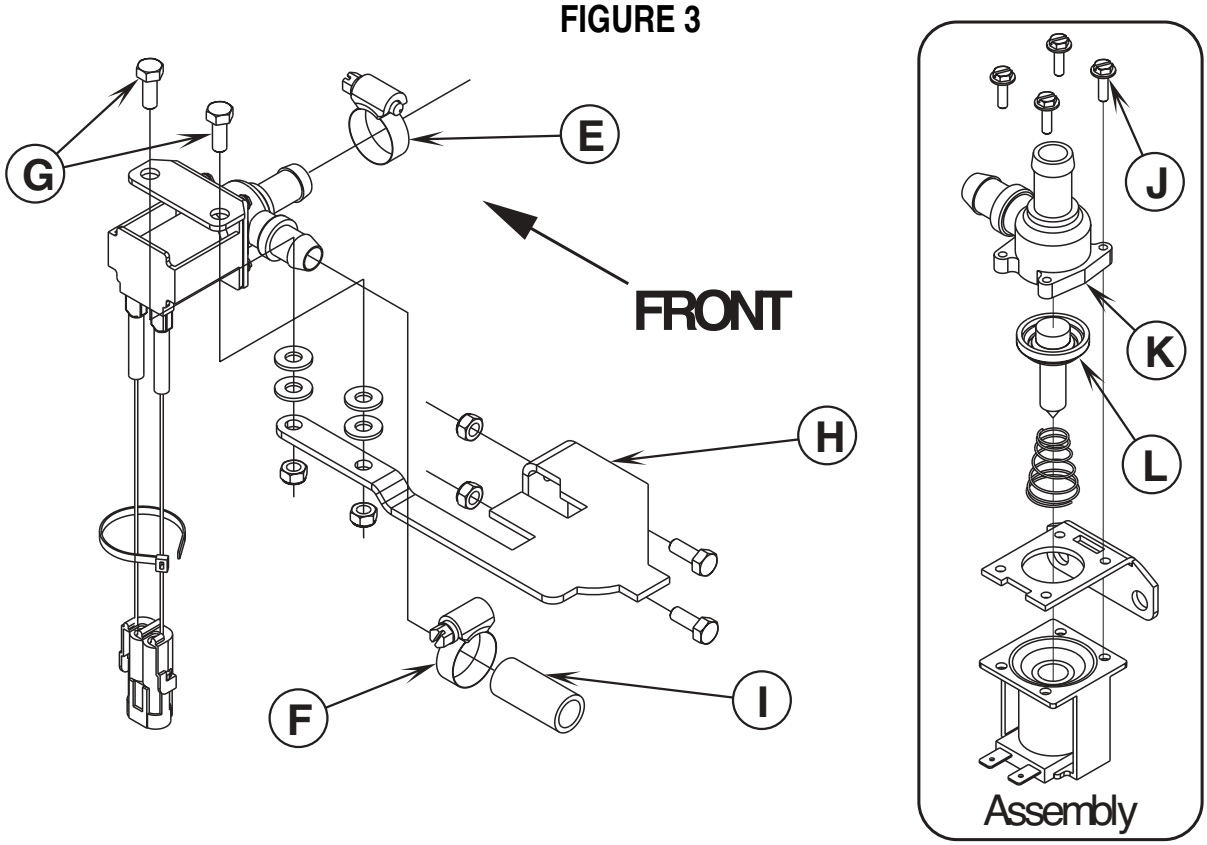

Solenoid will not open, no solution flow in auto mode (See Figure 3).
Verify scrub brushes are turning
No
See Brush System Troubleshooting Symptom 2 (part A&B).
Yes
Separate the wiring harness connector that feeds the L1 solenoid (2 wires Brn & Red/Grn). Test for 24V or 36V
No
Check for 24V or 36V (Pos.) from the Brn L1 harness feed wire to a (Neg.) battery standoff
No
Test continuity of the (Pos.) Brn wire from the S3 Key Switch to the L1 solution solenoid. Repair or replace defective wiring
Yes
Yes
Test the resistance of the L1 solenoid coil. If it reads infinity coil is open. If it reads x ohms or less it is shorted (a good coil should read 55 ohms ±10% for 24V or 128 ohms ±10% for 36V).
Check for 24V or 36V (Neg.) from the Red/Grn L1 harness feed wire to a (Pos.) battery standoff
No
Test continuity of the Red/Grn wire from the A1 board's #7 pin connection to the L1 solenoid.
No
Repair or replace the Neg. solution solenoid Red/Grn supply wire.
Yes
Yes
Test for 24V or 36V (Neg.) from the Yel A1 board's #3 wire to a (Pos.) battery standoff.
No
Replace the A2 speed control
Yes
Yes
Yes
Replace the L1 solenoid coil if testing shows it shorted or open.
Replace the A1 control board

SOLUTION SYSTEM

SOLENOID VALVE REMOVAL

1 Drain the solution tank or put the Flow Control Valve Knob **(A)** (shown in Figure 1) in the full off position to prevent solution loss.
2 Remove the lower left side chassis panel (held in place by 3 screws) and the left side scrub brush skirt assembly from the machine.
3 See Figure 3. Unplug the L1 solenoid valve wire assembly connection from the machine harness.
4 Loosen both the inlet and outlet Hose Clamps **(E)** and **(F)** that secure the hoses to the valve body.
5 Separate (pry) the solution outlet hose off from its valve body barbed fitting.
6 Remove the (2) Hex Screws **(G)** that secure the valve to the Mount Bracket **(H)**, then pull the valve body to the front separating it from the solution inlet Hose **(I)**, completing the part removal.

FIGURE 3



SOLENOID VALVE DISASSEMBLY AND CLEANING

1 Remove the solenoid valve. See the Solenoid Valve Removal section for instructions.
2 See Figure 3. Remove the (4) **(J)** Screws and disassemble the valve (be careful not to lose any internal parts).
3 Thoroughly wash dirt from block **(K)** and diaphragm **(L)**.
4 After reassembling, test the solenoid valve for proper operation.

SOLUTION FILTER REMOVAL

1 Drain the solution tank using the solution drain hose or put the flow control valve knob in the full off position to prevent solution loss.
2 See Figure 4A or 4B. Loosen the (2) Hose Clamps **(M)** and pry off the inlet solution hose from the filter head hose barb fitting.
3 Remove the (2) Hose Clamps **(N)** that secure the filter housing to the Mount Bracket **(H)**, then pull the valve body to the rear separating it from the solution outlet hose, completing the part removal.

SOLUTION FLOW CONTROL VALVE REMOVAL

1 Drain the solution tank using the drain hose.
2 See Figure 4A or 4B. Loosen the (2) Hose Clamps **(O)** and **(P)** and pry off inlet solution Hose **(Q)** from the flow control valve.
3 Remove the Philips head Screw **(R)** (using a short handled screwdriver) that secures the operator solution adjustment rod **(S)** to the ball valve arm and separate.
4 Remove the (2) Nuts **(T)** & Screws **(U)** that secure the valve Mount Bracket **(V)** to the chassis. Then pull the valve and bracket to the rear separating the valve from the solution outlet Hose **(W)**, completing the part removal.

FIGURE 4A CMAX™ 28ST, BA 750ST & BA 850ST

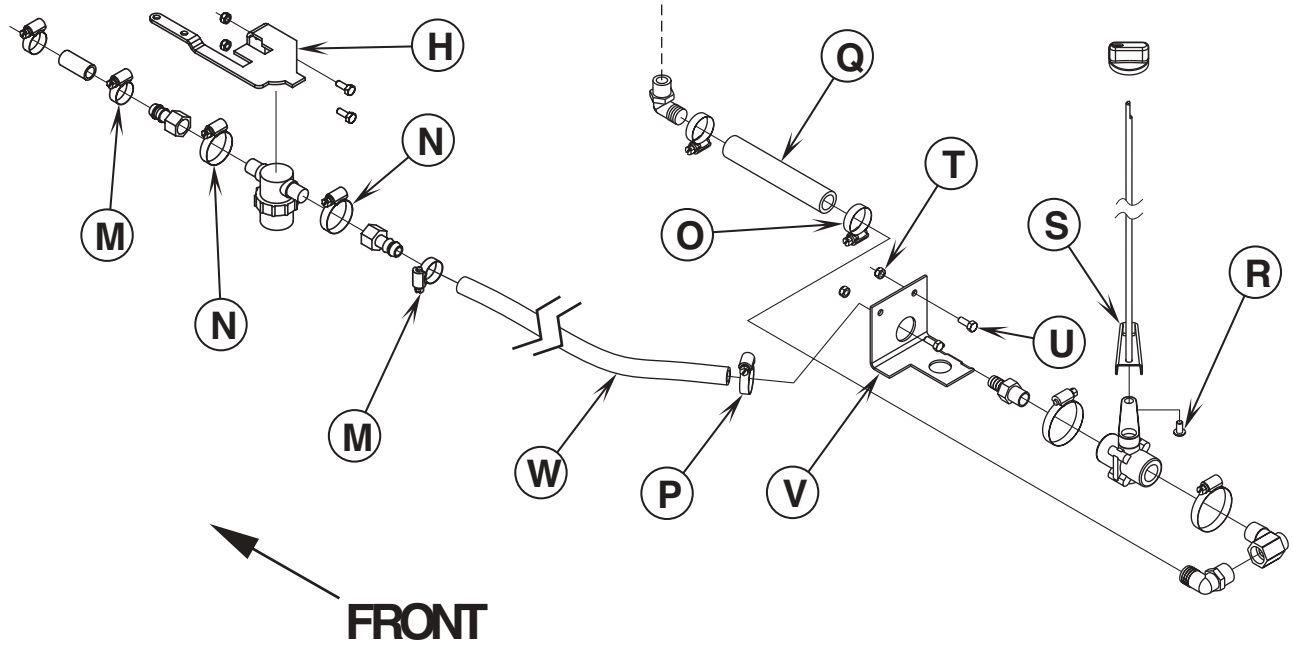
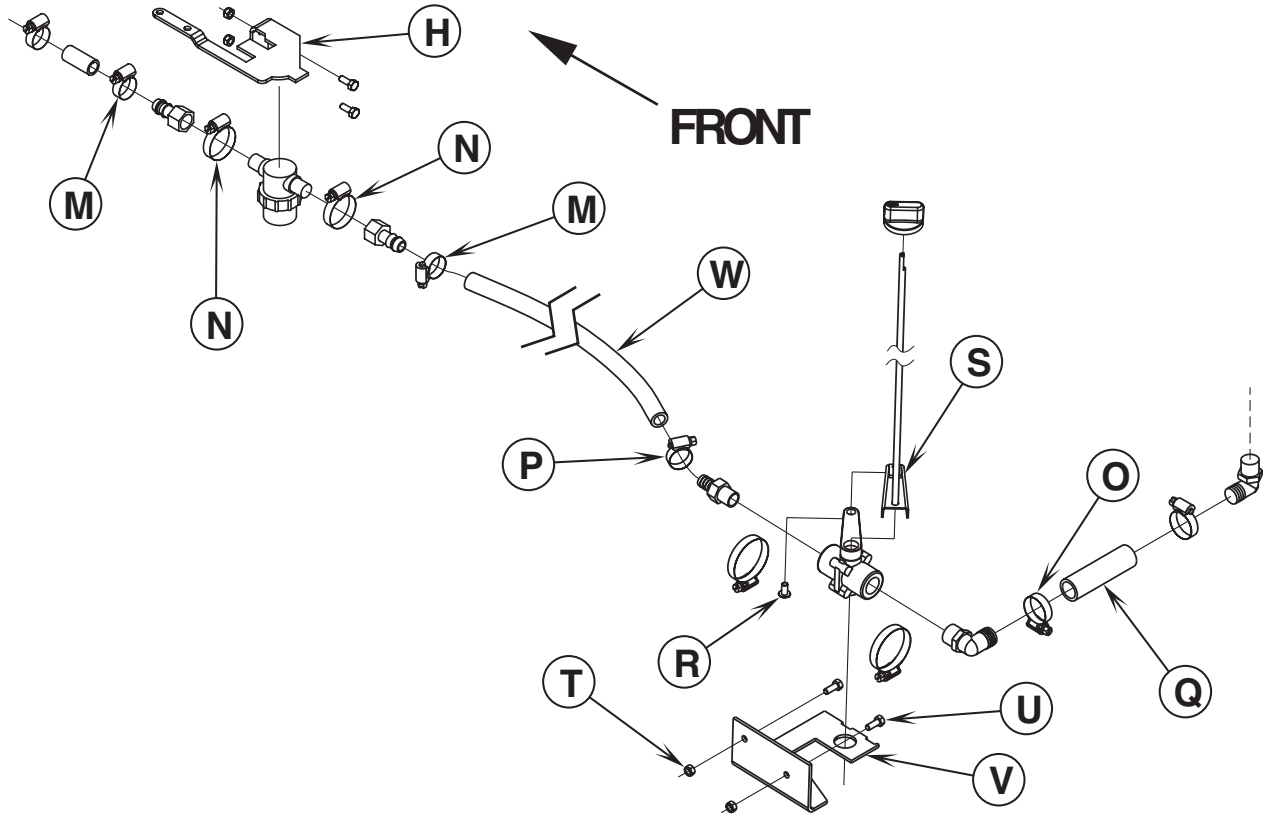


FIGURE 4B I-MAX™ 28C, I-MAX™ 32C, BA 750C & CMAX™ 34ST



SCRUB BRUSH SYSTEM

FUNCTIONAL OVERVIEW

• Disc Brush System Overview

See Figure 2. The machine models CMAX 28ST, CMAX 34ST, BA 750ST & BA 850ST (model #'s 56396010, 56397403, 56396011 & 56396012) use the disc type scrub system.

• Cylindrical Brush System Overview

See Figure 4. The machine models I-MAX 28C, I-MAX 32C & BA 750C (model #'s 56397400, 56397401 & 56397402) use two cylindrical brushes that counter rotate to sweep up light debris and scrub at the same time. Each scrub brush is powered on opposing ends by 3/4 HP permanent magnet motors attached to separate poly-V belt/pulley drives.

• General Brush Overview

On all models the scrub deck platform is raised & lowered automatically by a vertically mounted electric lift actuator motor. The operation of the machine's scrub functions are activated when the operator selects (presses) the scrub (mode) panel buttons. The scrub pad or brush pressure ranges (1-9) are selectable allowing the operator the choice to vary the scrubbing effort (pressure) while operating the machine. Note: See the Main Control Board Special Program Options section in this manual for more detailed operation and instructions to change scrub pressure settings.

See Figure 1. The machine's main scrub system input and output operating functions are regulated (managed) by the display panel and combined main control board A1. The major scrub system functions are…

• Scrub Brush Motor Run Function

Control Circuit Overview Scrub Brush Motor

+(Positive) Circuit input starts with:

- A closed S3 key switch supplies the needed positive voltage to the K1 brush solenoid coil and the A1 control board #1 terminal (Brn wires). Note: The A1 control board scrub-on/pressure increase button must also be depressed (enabled). This operator command lowers the brush deck.

-(Negative) Circuit input starts with:

- A battery negative ground input at the A1 control board terminal #4 and at the A2 speed controller terminal B- (T2).
- A negative voltage output from the A2 speed controller's P1 (pin #1) to the A1 control boards yellow wire (#3 terminal). Note: The A2 speed control auxiliary output (pin #1) occurs whenever the R1 directional/throttle pot is moved off its neutral setting. This operator command happens when the drive paddle is pushed or pulled to run the wheel drive motor in Forward or Reverse.
- A negative voltage output from the A1 board's terminal #5 Vio/Blk wire completes the K1 solenoid coil circuit (Pos. & Neg.) and pulls in the load contact making the brush motors run.

• Scrub Brush Actuator Lift Motor Function

The A1 control board outputs (terminals 11 & 12) activate (raise and lower) the scrub-deck for installing, removing and controlling the scrub brushes' selected current load. The large BLK negative (-) scrub brush motor wire is specially designed so that it has a known (specified) resistance value. As brush motor current passes through the negative wire that is, in effect, a low value resistor, a small voltage drop is developed across it which is proportional to the motor current. This voltage change is inputted to the A1 control board at terminal pins 8 and 2 (sense wires WHT/GRA & GRA/BLK). Any surrounding temperature change in this large Neg. motor wire affects its resistance so the temperature is sensed by a thermistor (*) built into the control board A1. This allows the controller to provide error correction for the temperature resistance changes. When the controller senses a current draw out of the desired range it automatically turns on the M5 actuator motor to raise or lower the scrub deck. This process is on going in maintaining the operator's selected scrub motor current load setting to sustain the desired brush working pressure.

• Low Voltage Cut-Out Function

The purpose of the special low battery voltage cutout function is to help prolong battery life. The scrub deck will be raised and the brush motors and solution solenoid valve will turn OFF automatically and cease to function when the batteries discharge to the selected cutout level. The cutout level is adjustable between two settings. The standard setting (wet cell/lead acid) is 1.72 volts per cell and alternate setting (gel/maintenance free) is 1.81 volts per cell. Note: See the battery system section for instructions for selecting (setting) the two different thresholds.

SPECIAL SCRUB SYSTEM FUNCTIONS

• Optional Scrub Brush Removal Function (Disc only)

For removal of the scrub brushes automatically, the scrub deck must be in the up position and the drive system in neutral. To remove the scrub brushes simply depress the control panel scrub-off/pressure decrease button **(H)** for 1 second. The A1 control board will momentarily run the brush motor and then stop it quickly, where the brush inertia causes the brush to easily spin itself off of the scrub brush motor drive cap.

• Control and Load circuit detail.

- A closed S3 key switch supplies the needed positive circuit inputs (Brn wire) to the K1 brush solenoid coil, K3 brush remove solenoid coil and A1 control board.

• Control and Load circuit detail (continued)

- The brush remove circuit sequence starts when the operator depresses the control panel scrub off/brush pressure decrease button **(H)** activating the A1 board's brush remove function. This triggers (starts) an internal timer relay closing the K1 coil ground circuit, pin #5 (Vio/Blk wire) turning on momentarily the brush solenoid to run the brush motors.
- Simultaneously with the K1 coil being turned on the same input command connects the battery ground connection through the A1 pin #10 wire (Org/Blk) to the K3 coil turning it ON.
- This pulls in the K3 load contact connecting it to the battery ground return.
- The next step is the board timer turning off the K1 brush solenoid and connecting the normally Pos. motor load circuit to a battery ground return (through the K3 load contact and K1 normal closed contact).
- With two battery ground inputs at the brush motors this circuit causes a short to ground and the motors stop abruptly. The built up brush inertia easily spins the brushes off the motor drive disc lugs.

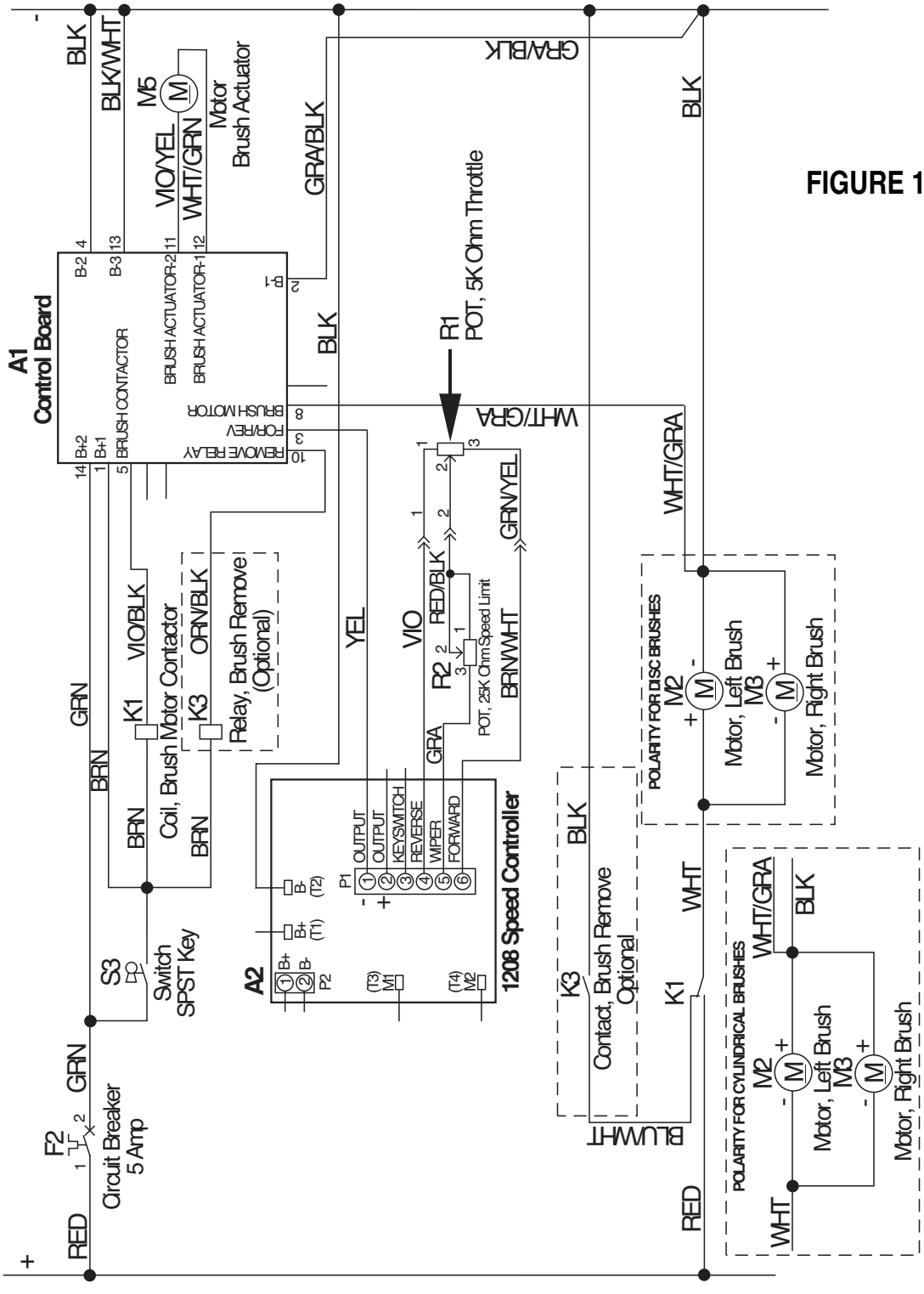


FIGURE 1

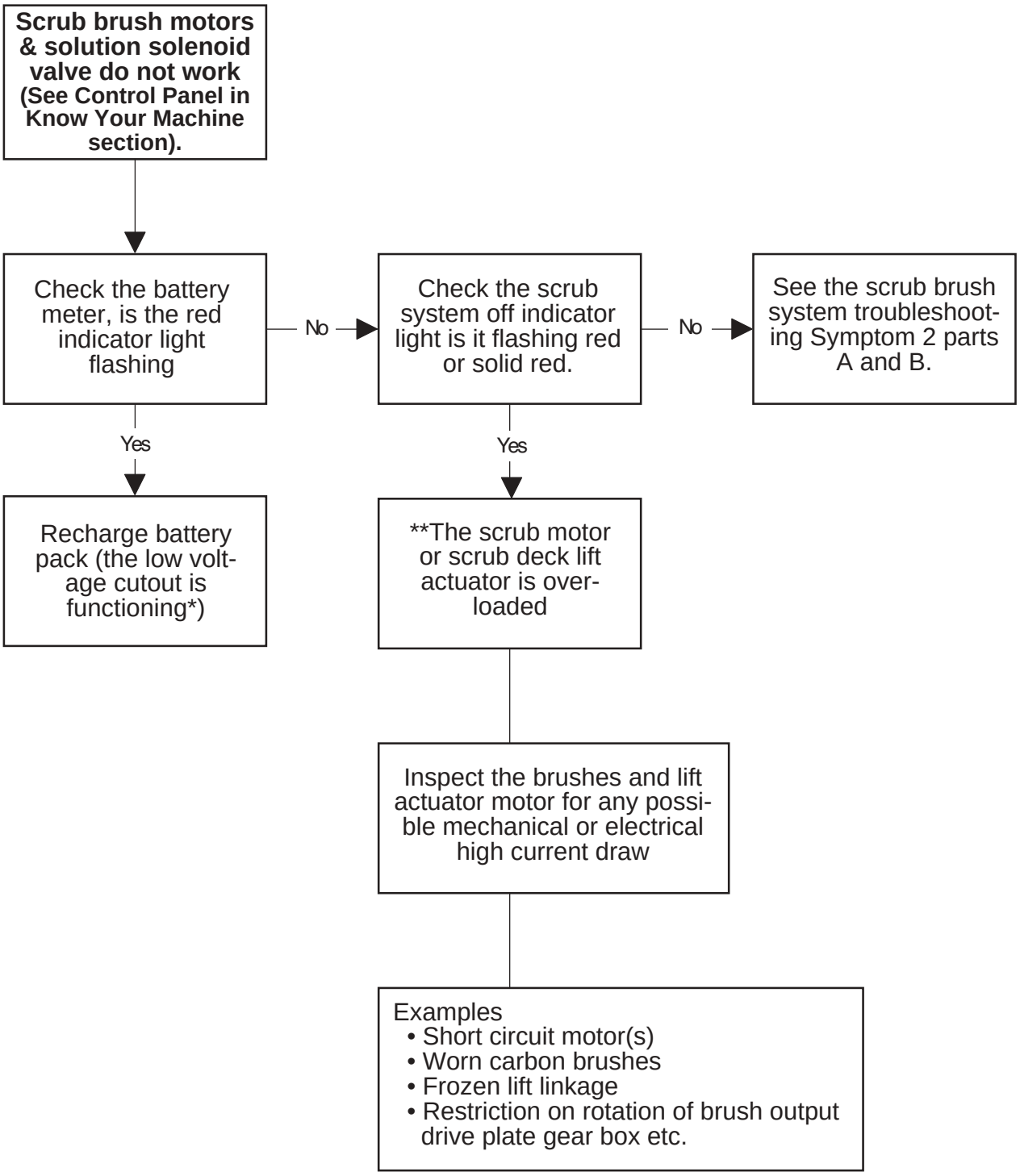
SCRUB BRUSH SYSTEM

TROUBLESHOOTING GUIDE ELECTRICAL

Possible Symptoms

1 Scrub brush motors and solution solenoid valve do not work
2 Scrub brush motors do not work
3 Scrub brush auto remove function does not work (optional)

SYMPTOM ONE


Scrub brush motors & solution solenoid valve do not work (See Control Panel in Know Your Machine section).
Check the battery meter, is the red indicator light flashing
No
Check the scrub system off indicator light is it flashing red or solid red.
No
See the scrub brush system troubleshooting Symptom 2 parts A and B.
Yes
Yes
Recharge battery pack (the low voltage cutout is functioning*)
**The scrub motor or scrub deck lift actuator is overloaded
Inspect the brushes and lift actuator motor for any possible mechanical or electrical high current draw
Examples
• Short circuit motor(s)
• Worn carbon brushes
• Frozen lift linkage
• Restriction on rotation of brush output drive plate gear box etc.

*Reference the Description of the Battery Low Voltage Cutout Feature in the Electrical System of this manual.

**When experiencing a scrub system overload, the scrub and solution systems will turn off and the scrub-off/pressure-decrease indicator will flash red at a fast rate (four times per second). Correct the cause of the overload and to reset, turn the key switch off and then back on.

TROUBLESHOOTING GUIDE (CONTINUED)

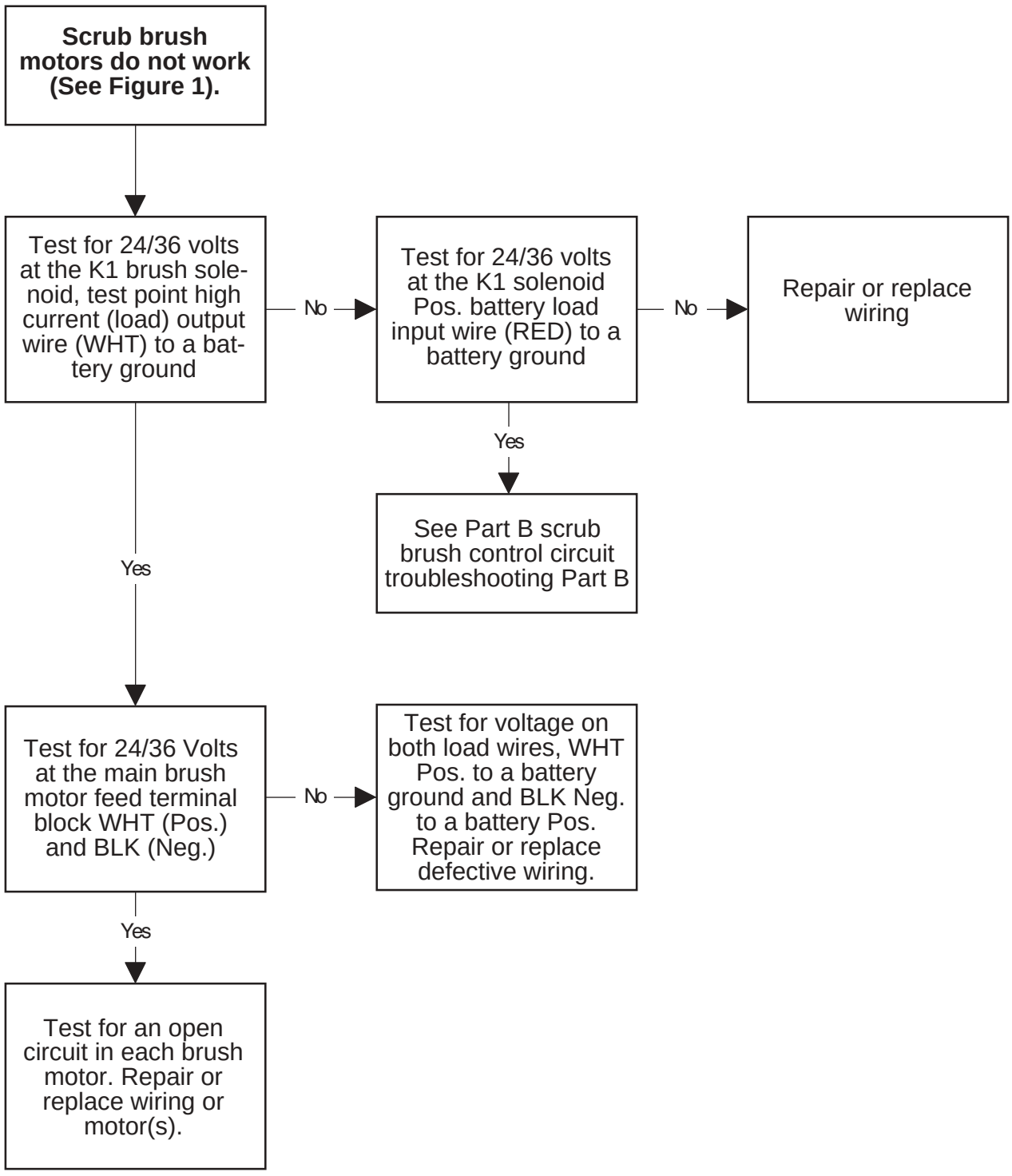
SYMPTOM TWO

Scrub Brush Motors Do Not Work

Note: Do all testing with key switch on, scrub on switch activated (scrub deck lowered) and drive paddle activated (pushed Fwd or pulled into Rev).

Note 2: Enter the Service Test Mode Program in the Electrical System manual section, for **alternate** machine troubleshooting procedures.

Part A: Scrub Brush Motor Load Circuit Troubleshooting Guide


Scrub brush motors do not work (See Figure 1).
Test for 24/36 volts at the K1 brush solenoid, test point high current (load) output wire (WHT) to a battery ground
No
Test for 24/36 volts at the K1 solenoid Pos. battery load input wire (RED) to a battery ground
No
Repair or replace wiring
Yes
See Part B scrub brush control circuit troubleshooting Part B
Yes
Test for 24/36 Volts at the main brush motor feed terminal block WHT (Pos.) and BLK (Neg.)
No
Test for voltage on both load wires, WHT Pos. to a battery ground and BLK Neg. to a battery Pos. Repair or replace defective wiring.
Yes
Test for an open circuit in each brush motor. Repair or replace wiring or motor(s).

SCRUB BRUSH SYSTEM

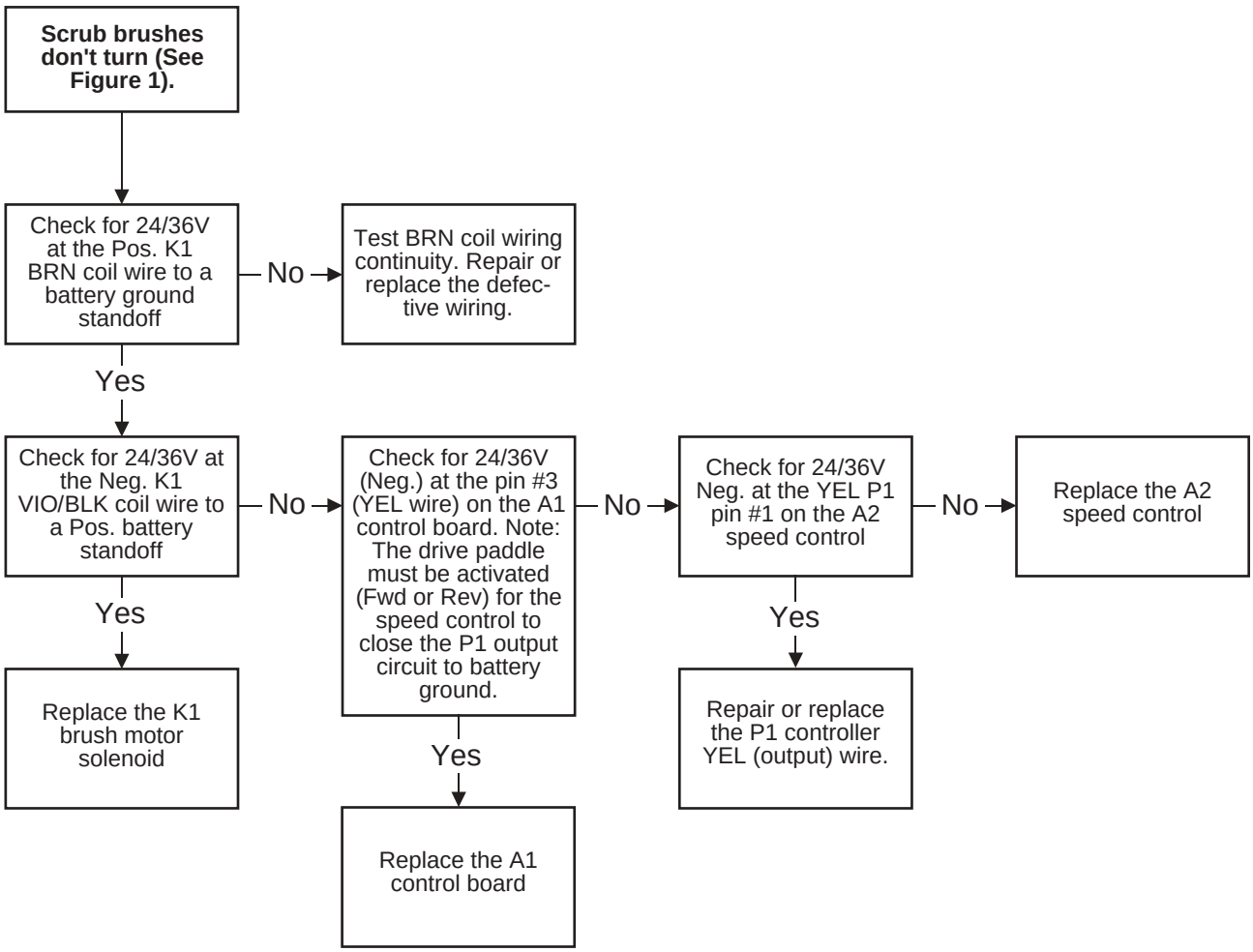
TROUBLESHOOTING GUIDE (CONTINUED)

SYMPTOM TWO

Scrub Brush Motors Do Not Work

Note: Do all testing with key switch on, scrub on switch activated (scrub deck lowered) and drive paddle activated (pushed Fwd or pulled into Rev).

Part B: Scrub Brush Motor Control Circuit Troubleshooting Guide


Scrub brushes don't turn (See Figure 1).
Check for 24/36V at the Pos. K1 BRN coil wire to a battery ground standoff
No
Test BRN coil wiring continuity. Repair or replace the defective wiring.
Yes
Check for 24/36V at the Neg. K1 VIO/BLK coil wire to a Pos. battery standoff
No
Check for 24/36V (Neg.) at the pin #3 (YEL wire) on the A1 control board. Note: The drive paddle must be activated (Fwd or Rev) for the speed control to close the P1 output circuit to battery ground.
No
Check for 24/36V Neg. at the YEL P1 pin #1 on the A2 speed control
No
Replace the A2 speed control
Yes
Replace the K1 brush motor solenoid
Yes
Replace the A1 control board
Yes
Repair or replace the P1 controller YEL (output) wire.

TROUBLESHOOTING GUIDE (CONTINUED)

SYMPTOM THREE

Scrub Brush Auto Removal Function Does Not Work (Optional)

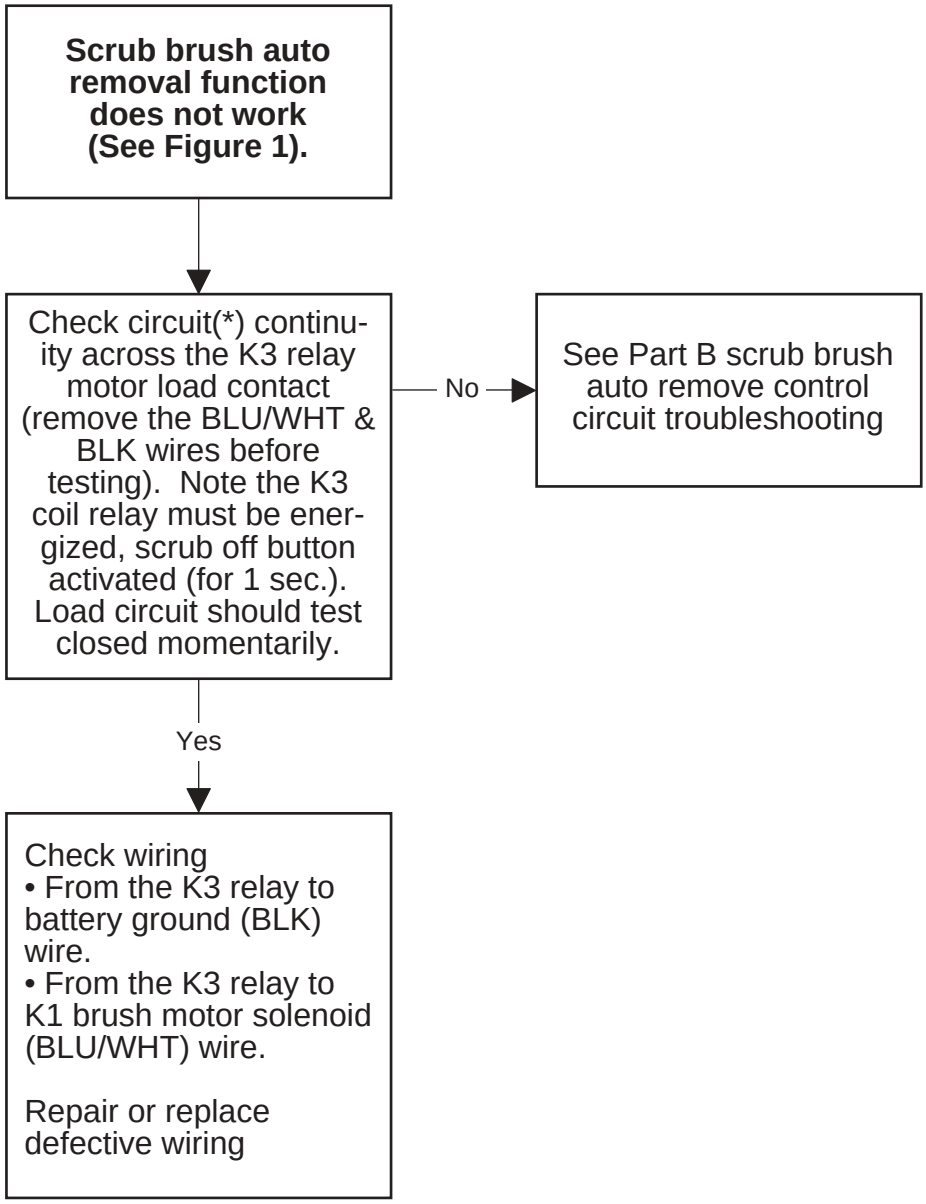
Note before troubleshooting: Check that the automatic remove function is selected (E) enabled. To do this go into the special program option section (electrical system) for instructions to follow to enable or disable the brush remove function.

Special Service Note: Read the brush remove function circuit detail in the previous brush system overview section

To test: Have the key switch ON, scrub deck raised and the drive system in neutral. Next to remove the brushes simply depress the control panel scrub OFF switch (**H**) for one second.

Note 2: Enter the Service Test Mode Program in the Electrical System manual section, for **alternate** machine troubleshooting procedures.

Part A: Scrub Brush Auto Remove Load Circuit Troubleshooting Guide


Scrub brush auto removal function does not work (See Figure 1).
Check circuit(*) continuity across the K3 relay motor load contact (remove the BLU/WHT & BLK wires before testing). Note the K3 coil relay must be energized, scrub off button activated (for 1 sec.). Load circuit should test closed momentarily.
No
See Part B scrub brush auto remove control circuit troubleshooting
Yes
Check wiring
• From the K3 relay to battery ground (BLK) wire.
• From the K3 relay to K1 brush motor solenoid (BLU/WHT) wire.
Repair or replace defective wiring

*****Alternate method to turn on remove relay. See service test mode section and follow the how to control the remove relay under the scrub off/ pressure decrease switch explanation.

SCRUB BRUSH SYSTEM

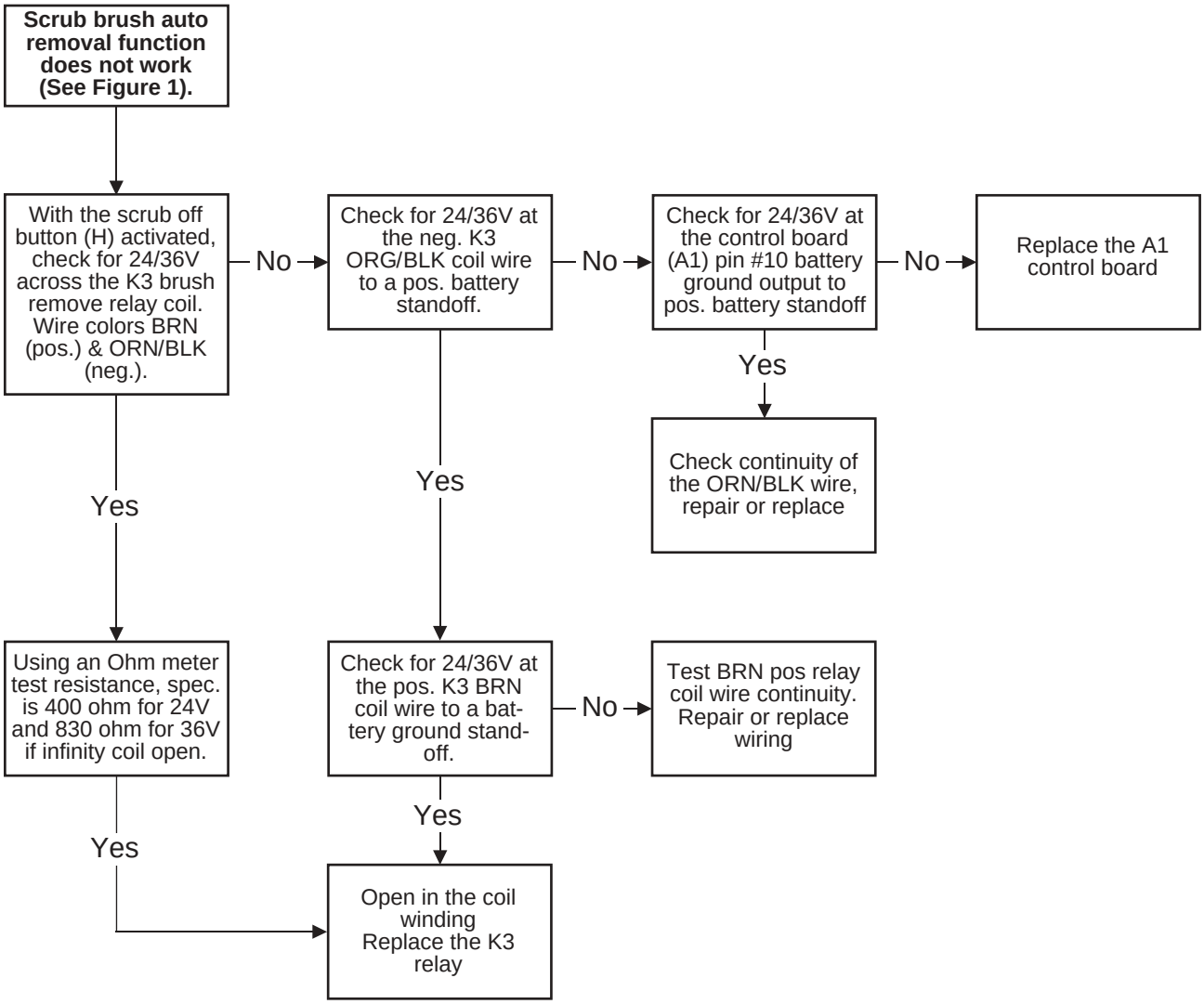
TROUBLESHOOTING GUIDE (CONTINUED)

SYMPTOM THREE

Scrub Brush Auto Removal Function Does Not Work (Optional)

To test: Have the key switch ON, scrub deck raised and the drive system in neutral. Next to remove the brushes simply depress the control panel scrub OFF switch **(H)** for one second.

Part B: Scrub Brush Auto Remove Control Circuit Troubleshooting Guide


Scrub brush auto removal function does not work (See Figure 1).
With the scrub off button (H) activated, check for 24/36V across the K3 brush remove relay coil. Wire colors BRN (pos.) & ORN/BLK (neg.).
No
Check for 24/36V at the neg. K3 ORG/BLK coil wire to a pos. battery standoff.
No
Check for 24/36V at the control board (A1) pin #10 battery ground output to pos. battery standoff
No
Replace the A1 control board
Yes
Check continuity of the ORN/BLK wire, repair or replace
Yes
Yes
Using an Ohm meter test resistance, spec. is 400 ohm for 24V and 830 ohm for 36V if infinity coil open.
Check for 24/36V at the pos. K3 BRN coil wire to a battery ground standoff.
No
Test BRN pos relay coil wire continuity. Repair or replace wiring
Yes
Yes
Open in the coil winding Replace the K3 relay

SCRUB BRUSH DECK REMOVAL (DISC)

1 Remove the machine's molded front panel (held in place by 6 screws). Note: Use a 1/4 inch Allen (hex key) wrench on the front cover screws and a 5/16 inch wrench on the side screws.
2 With scrub brushes installed and the brush deck in the up (storage) position disconnect the actuator motor wiring harness pig tail connector.
3 Next connect the Nilfisk-Advance actuator power cord adapter (PN 56407502) to the machine's battery pack and lift actuator motor pig tail connector.
4 Press the cord adapter rocker switch to momentarily run (jog) the actuator output (up and down) to a position where the bottom deck Actuator Pin **(H)** is loose (see Figure 2). Remove the Cotter Pin **(I)** from the lower Actuator Pin **(H)** and pull the pin from the mount bracket, to separate the lower actuator mounting point.
5 Remove the left side chassis panel from the machine (3 screws).
6 Remove the Solution Hose **(A)** from the outlet barb at the solenoid valve.
7 Remove the (4) sets of hardware items **(B)**, **(C)** & **(D)** from the deck Lift Arms **(E)** (two hardware groupings from the left front and two from right rear) as shown. Note: Don't lose the Bearing Sleeve **(F)** and Bushing **(G)** insert in the ends of the lift support arms.
8 Pull the scrub deck forward 12 inches (30cm) to access the motor wiring terminal block.
9 Remove the motor wiring at the terminal block and then pull the brush head assembly completely from the machine. Note: See Figure 3 for the correct wiring illustration for rewiring each model.

SCRUB BRUSH LIFT ACTUATOR REMOVAL (DISC)

1 Remove the machine's molded front panel (held in place by 6 screws). Note: Use a 1/4 inch Allen (hex key) wrench on the front cover screws and a 5/16 inch wrench on the side screws.
2 With scrub brushes installed and the brush deck in the up (storage) position disconnect the actuator motor wiring harness pig tail connector.
3 Next connect the Nilfisk-Advance actuator power cord adapter (PN 56407502) to the machine's battery pack and lift actuator motor pig tail connector.
4 Press the cord adapter rocker switch to momentarily run (jog) the actuator output (up and down) to a position where the bottom deck Actuator Pin **(H)** is loose (see Figure 2). Remove the Cotter Pin **(I)** from the lower Actuator Pin **(H)** and pull the pin from the mount bracket.
5 Remove the Hex Screw **(J)** and Nut **(K)** that secures the upper Actuator Yoke **(L)** at the frame mount.
6 Tilt the motor assembly to the rear then maneuver the actuator out of the machine from the front of the brush deck.
7 See ***Important Service Note** below.

Note: If the lift actuator motor will not run it will be necessary to jack up the front of the machine or shim up the brush deck to remove the weight on the lower deck Actuator Pin **(H)** to remove.

***Important Service Note:** After removing any actuator motor and before installing a new motor or drive nut the IN and OUT limit switches must be set (or checked) to their correct specifications. Reference the Electrical System in this manual for the Actuator Drive Nut Adjustment and follow these instructions before replacing the actuator motor.

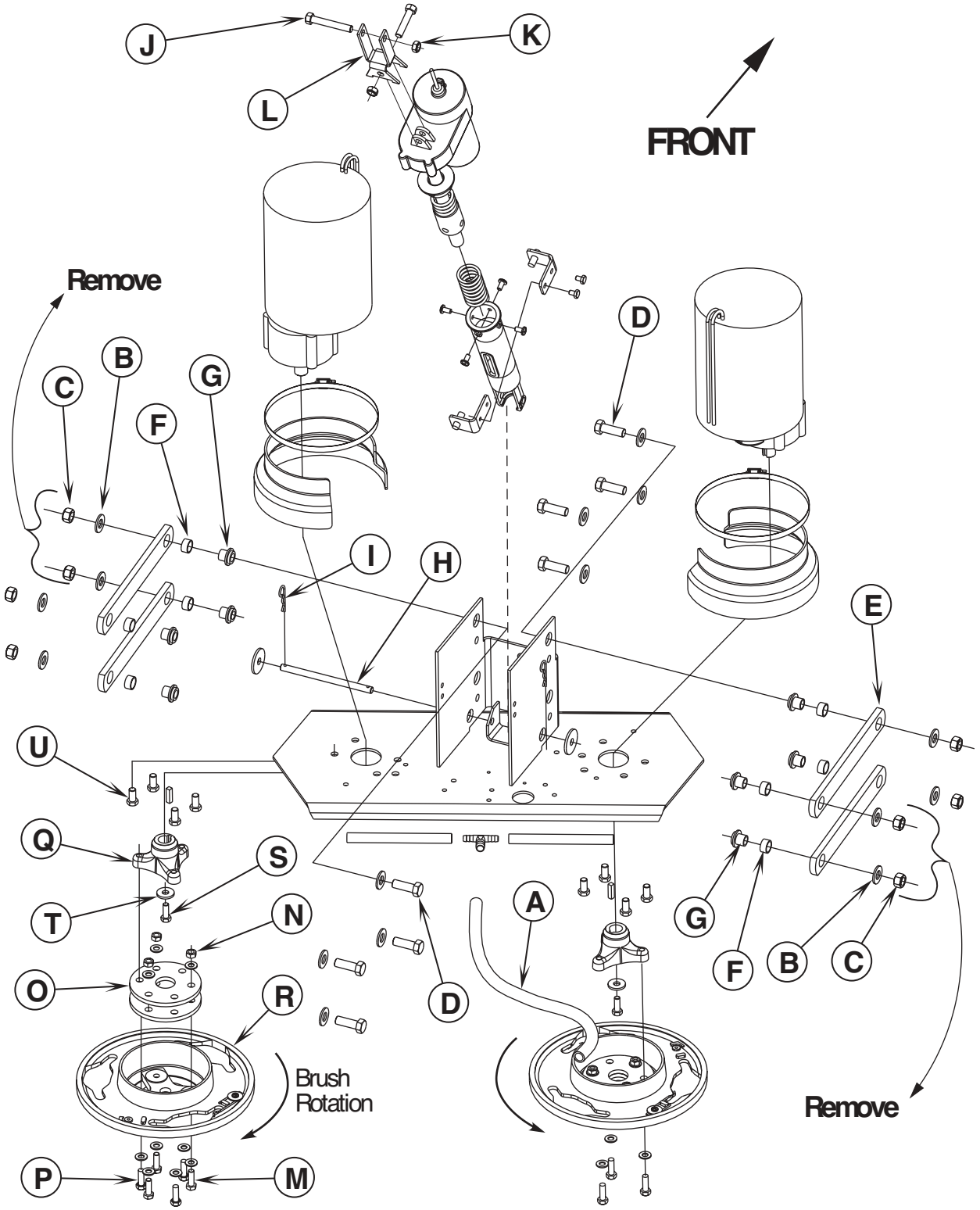
After setting the correct actuator nut adjustments for the scrub brush lift motor, follow removal steps in reverse order to reassemble.

SCRUB BRUSH MOTOR/GEARBOX REMOVAL (DISC)

1 Follow steps 1-9 in the Scrub Brush Deck Removal (Disc) section.
2 Turn the brush deck on its side.
3 Remove the scrub brushes from the brush holders then mark the location of the motor to the brush deck for proper re-assembly.
4 See Figure 2. Remove the (3) **(M)** Hex Screws and (3) **(N)** Nuts from each Flexible Coupler **(O)**.
5 Next remove the (3) Hex Lock Screws **(P)** that connect the coupler to the Drive Hubs **(Q)** and remove the brush holder(s) **(R)**.
6 Remove the hardware items **(S & T)** that secure the Hub **(Q)** to the output shaft on each gearbox. Then pull the hub from the shaft and save the key.
7 Remove the (4) **(U)** Screws and separate the motor/gearbox assembly from the scrub deck that needs replacement.
8 Re-assemble in reverse order and test for proper operation. Note: Apply a small amount of grease or a product called "Never Seize" to the gearbox output shaft when reinstalling the Drive Hub(s) **(Q)**.

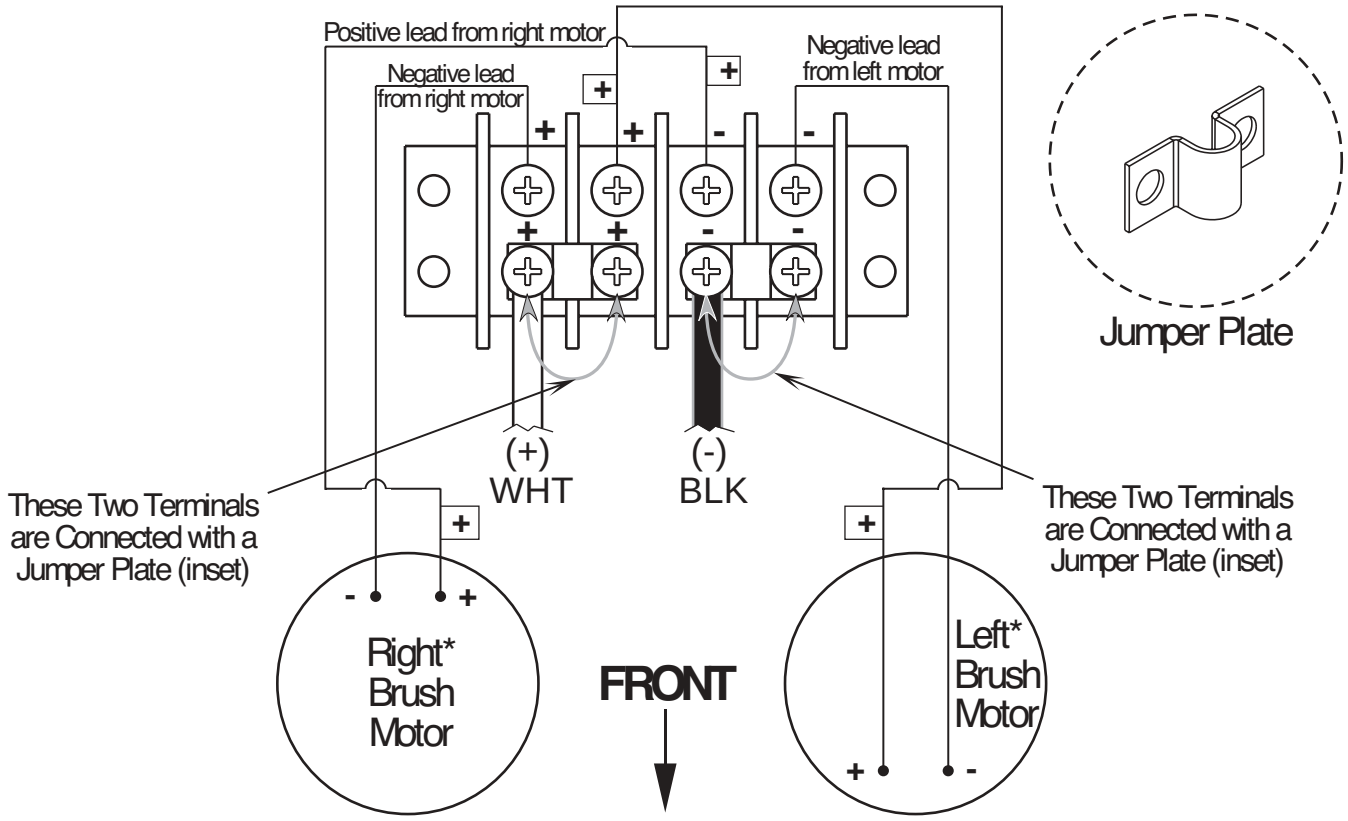
SCRUB BRUSH SYSTEM

FIGURE 2



Note: Figure 2 shows the scrub brush components of the CMAX™ 28ST, BA 750ST and BA 850ST. Similar components are found on the CMAX™ 34ST.

FIGURE 3


Positive lead from right motor
Negative lead from right motor
Negative lead from left motor
Jumper Plate
(+) WHT
(-) BLK
These Two Terminals are Connected with a Jumper Plate (inset)
These Two Terminals are Connected with a Jumper Plate (inset)
Right* Brush Motor
FRONT
Left* Brush Motor

Motor wiring for: CMAX™ 28ST, CMAX™ 34ST, BA 750ST and BA 850ST
*Right and left are identified as seen from the rear of the machine.

SCRUB BRUSH SYSTEM

SCRUB BRUSH DECK ASSEMBLY REMOVAL (CYLINDRICAL)

1 Have the recovery tank drained. Then with the scrub brushes installed lower the brush deck, turn off key switch and disconnect the battery pack connector.
2 Remove the machine's molded front panel (held in place by 6 screws). Note: Use a 1/4 inch Allen (hex key) wrench on the front cover screws and a 5/16 inch wrench on the side screws.
3 Remove from the deck the debris tray. Next remove the solution delivery hose and clamp from the solution Tee fitting (See Figure 4). Then pull the hose back out through the deck's lower actuator housing mount bracket.
4 Remove the Retaining Ring **(V)** and Pin **(W)** that secures the lower actuator (plastic) housing to its deck mount.
5 Note the correct wire connections to the scrub brush motors (for reinstallation) then remove the motor wiring at both Pos. and Neg. terminal standoffs.
6 Using both a 17mm & 19mm wrenches remove the four sets of hardware items **(X, Y, Z & AA)** from the front deck lifting arms **(AB** & **AC)**.
7 **Service Tip:** Do not disturb (change) the setting to the dismounted lift actuator plastic housing, for ease in re-assembly. Use a piece of tape to secure it to the motor.
8 Carefully pull the deck forward to clear the lift actuator motor assembly and then slide it out from underneath the machine.

SCRUB BRUSH MOTOR(S) REMOVAL (CYLINDRICAL)

1 Have the recovery tank drained. Then with the scrub brushes installed lower the brush deck, turn off key switch and disconnect the battery pack connector.
2 Remove the brush head cover (held in place by 6 screws). Note: Use a 1/4 inch Allen (hex key) wrench on the front cover screws and a 5/16 inch wrench on the side screws.
3 See Figure 4. First remove the rear scrub deck Side Skirts **(AD)** held by (3) screws. Next remove the belt guards held in place by (4) screws.
4 Next loosen the scrub brush belt tension Hex screw in the center of the Belt Idler **(AE)** (using a 5/8" wrench).
5 See Figure 6 for motor wiring. Remove the wiring at both the Pos. & Neg. brush motor terminal studs and note the correct wiring connections (for reinstallation). Then remove the (3) Screws **(AF)** and lift the motor out from the front or rear of the scrub deck.
6 Reassemble in reverse order and adjust the belt tension to 13/16-7/8 inches (20-22mm) as shown in Figure 5.

SCRUB BRUSH BELT REPLACEMENT (CYLINDRICAL)

1 See Figure 4. First remove the rear scrub deck Side Skirts **(AD)** held by (3) screws. Next remove the belt guards held in place by (4) screws.
2 **Important Service Tip:** The left and right side drive belts are not the same lengths they must be ordered individually (P.N. 56407465, left side & P.N. 56407466, right side).
3 Loosen the scrub brush belt tension hardware on the Belt Idler Pulley **(AE)** (using a 5/8" wrench). Pull the idler wheel away from the backside of the belt and roll the belt off both the motor and brush pulleys. Then inspect for wear and replace as needed.
4 Re-install the drive belt and tension the belt as shown in Figure 5. Then install the belt guard, Side Skirts **(AD)**, reconnect the battery pack and test the scrub system for proper operation.

SCRUB BRUSH SYSTEM MAINTENANCE (CYLINDRICAL)

The scrubbing system must be serviced at regular intervals to maintain good scrubbing performance. Follow the maintenance steps listed below.

1 Rinse clean, built up debris from the debris hopper drain holes (daily).
2 Clean drain holes in the solution delivery trough on top of the scrub deck (weekly).
3 Clean built up dirt from the inside of the scrub brush housing (weekly).
4 Remove any string wrapped around the scrub brush, drive hub and idler hub (weekly).
5 Remove both the scrub brushes and rotate, turn end for end (weekly). See Scrub Brush Removal and Installation (Cyl) section.
6 Inspect the scrub brush bristles for wear, the brushes should be replaced when the bristle length is 1 inch (26mm) or less (monthly).

SCRUB BRUSH REMOVAL AND INSTALLATION (CYLINDRICAL)

1 Make sure the key switch is off and disconnect the battery pack before servicing.
2 Loosen the black knobs (one on each side) that secure the removable bearing idler support Plate **(AG)** to the brush housing, then pull the plates down and out to remove. Grip the scrub brush and slide it from the housing end.
3 To install the brush slide it into the housing, lift slightly, push and turn until it seats into the drive end assembly.
4 Re-install the idler end plate assemblies.

SCRUB BRUSH LIFT ACTUATOR REMOVAL (CYLINDRICAL)

1 Remove the machine's molded front panel (held in place by 6 screws). Note: Use a 1/4 inch Allen (hex key) wrench on the front cover screws and a 5/16 inch wrench on the side screws.
2 With scrub brushes installed and the brush deck in the up (storage) position disconnect the actuator motor wiring harness pig tail connector.
3 Next connect the Nilfisk-Advance actuator power cord adapter (PN 56407502) to the machine's battery pack and lift actuator motor pig tail connector.

SCRUB BRUSH LIFT ACTUATOR REMOVAL (CYL) (CONTINUED)

4 Press the cord adapter rocker switch to momentarily run (jog) the actuator output (up and down) to a position where the bottom deck Actuator Pin **(W)** is loose (see Figure 4). Remove the Retaining Ring **(V)** from the lower Actuator Pin **(W)** and pull the pin from the mount bracket.

5 Remove the Hex Screw **(AH)** and Nut **(AI)** that secures the upper Actuator Yoke **(AJ)** at the frame mount.

6 Tilt the motor assembly to the rear then maneuver the actuator out of the machine from the front of the brush deck.

7 See ***Important Service Note** below.

Note: If the lift actuator motor will not run it will be necessary to jack up the front of the machine or shim up the brush deck to remove the weight on the lower deck Actuator Pin **(W)** to remove.

***Important Service Note:** After removing any actuator motor and before installing a new motor or drive nut the IN and OUT limit switches must be set (or checked) to their correct specifications. Reference the Electrical System in this manual for the Actuator Drive Nut Adjustment and follow these instructions before replacing the actuator motor.

After setting the correct actuator nut adjustments for the scrub brush lift motor, follow removal steps in reverse order to reassemble.

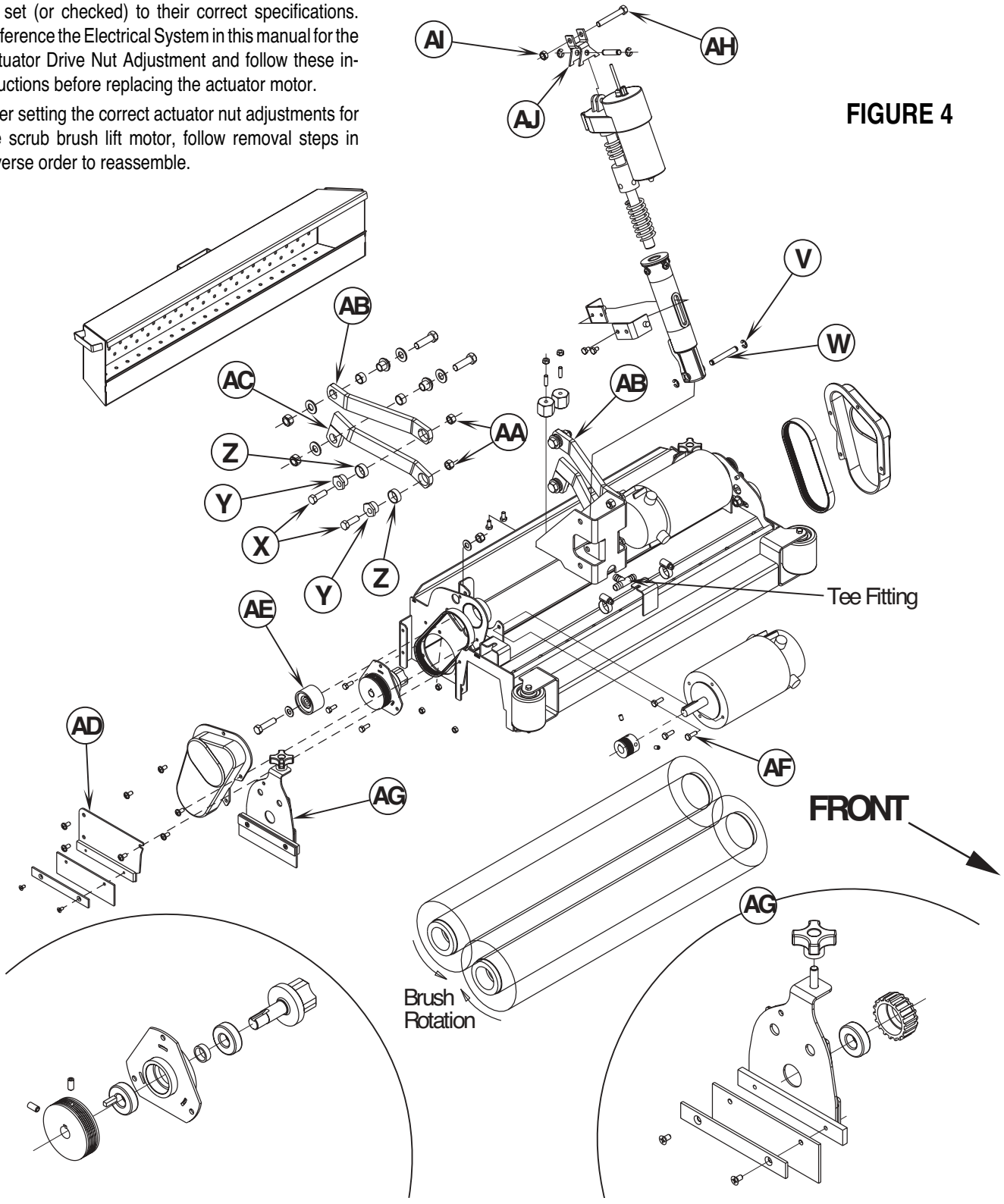


FIGURE 4

SCRUB BRUSH SYSTEM

FIGURE 5

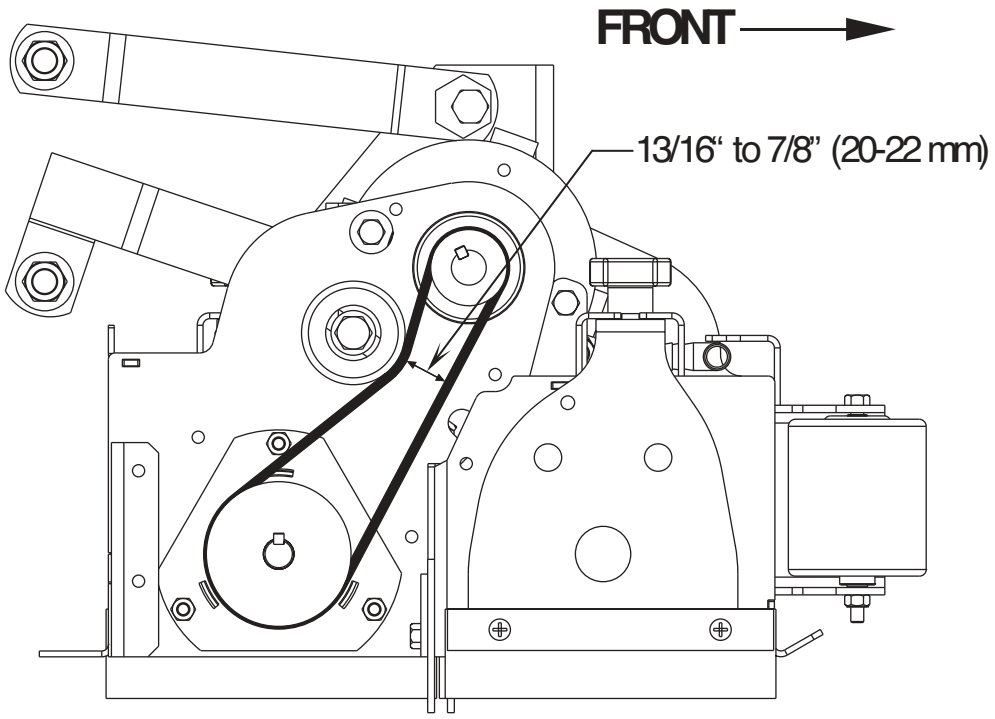
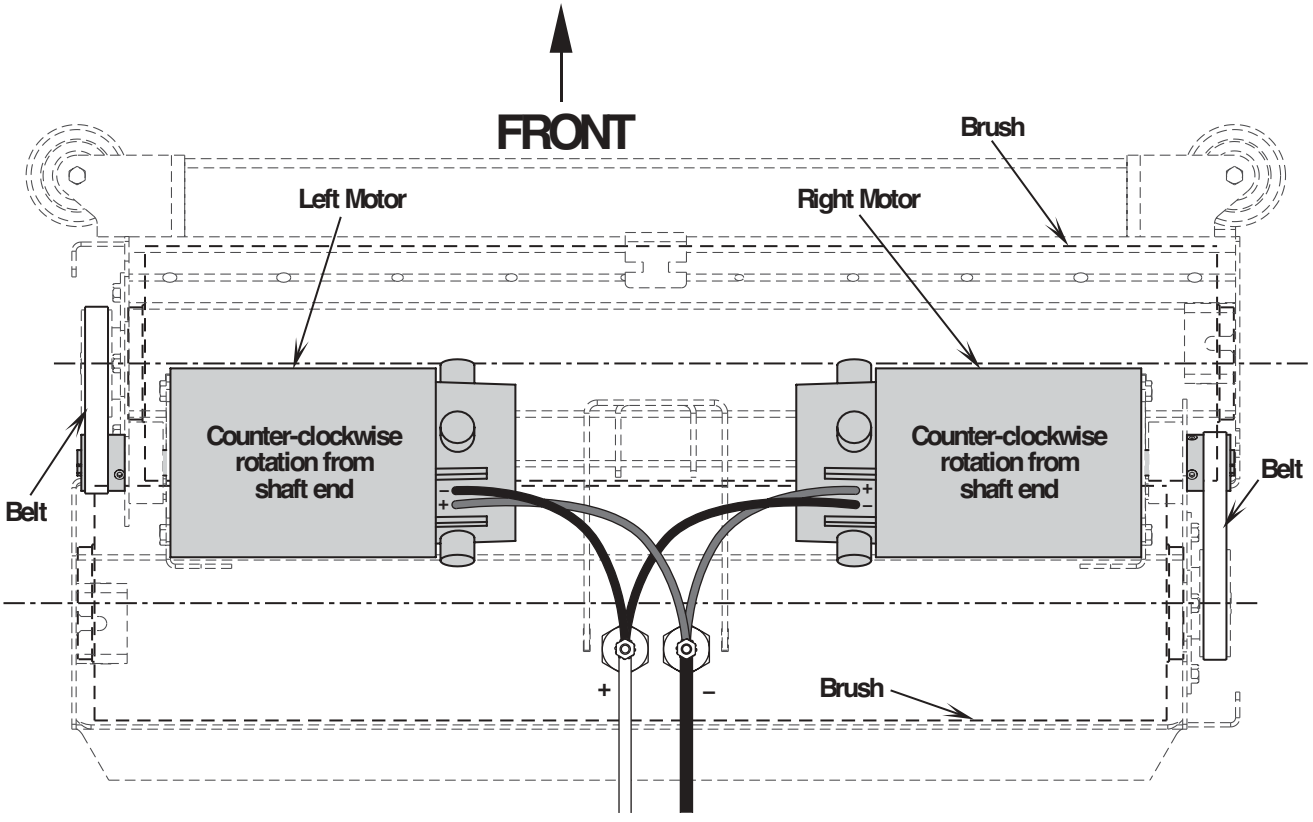


FIGURE 6



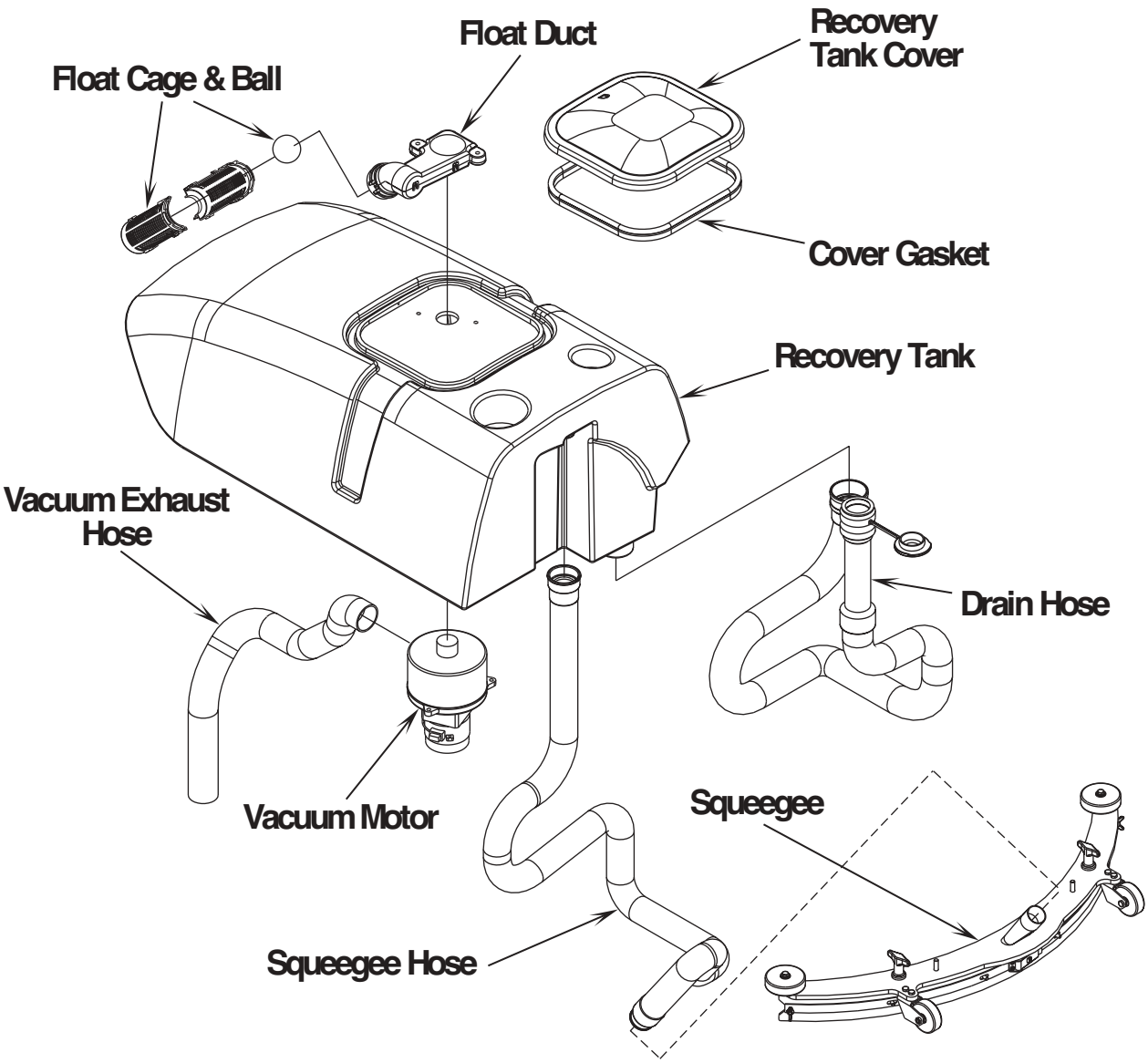
FUNCTIONAL OVERVIEW

Vacuum / Recovery System General

Dirt and water are lifted off the floor into the recovery tank by airflow, created by a 3-Stage 24V or 36V vacuum motor. The wastewater and air enter the vacuum system at the squeegee tool, through small openings (notches) located in the front squeegee blade. The small openings are the entrance points for the water and air, and help speed up the airflow producing the suction to lift the wastewater off of the floor. The air and wastewater move through the squeegee hose at high speed until it reaches the recovery tank. There the air slows down because of the increased volume (large size) of tank. With the decreased air speed the heavier water falls to the bottom of the recovery tank. Then at the same time the airflow continues through the tank, shutoff float, vacuum motor and is exhausted out of the vacuum exhaust hose. No wastewater ever actually moves through the vacuum motor, just clean air.

The vacuum system uses a shutoff float to prevent the tank from being overfilled and stops any water from being sucked into the vacuum motor.

FIGURE 1



Note: Figure 1 shows the vacuum recovery components of the CMAX™ 28ST, BA 750ST and BA 850ST. Similar components are found on the CMAX™ 34ST, I-MAX™ 28C, I-MAX™ 32C and BA 750C.

RECOVERY SYSTEM

VACUUM MOTOR CONTROL CIRCUIT OVERVIEW (AUTO MODE)

See Figure 2.

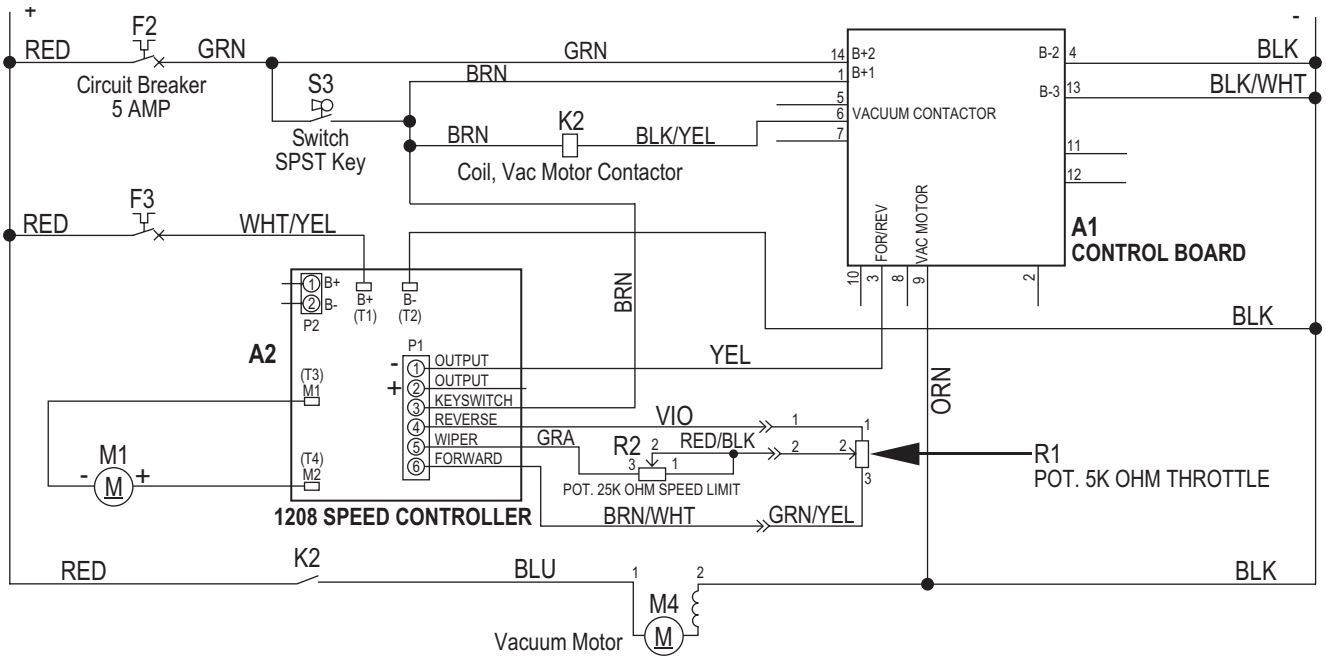
+(Positive) Circuit input starts with:

- A closed S3 key switch supplies the needed positive voltage to the K2 vacuum motor solenoid coil and the A1 control board #1terminal (Brn wires). Note: The A1 control board scrub-on/pressure increase button must also be depressed (enabled). This operator command lowers the brush deck.

-(Negative) circuit input starts with:

- A battery negative ground input at the A1 control board terminal #4 and at the A2 speed controller terminal B- (T2).
- A negative voltage output from the A2 speed controller's P1 (pin #1) to the A1 control boards yellow wire (#3 terminal). Note: The A2 speed control auxiliary output (pin #1) occurs whenever the R1 directional/throttle pot is moved off its neutral setting. This operator command happens when the drive paddle is pushed or pulled to run the wheel drive motor in Fwd or Rev.
- A negative voltage output from the A1 board's terminal #6 Blk/Yel wire completes the K2 solenoid coil circuit (Pos. & Neg.) and pulls in the solenoid load contact making the vacuum motor run.

FIGURE 2



Electrical Diagram

*For complete description of all callouts see Electrical System *Wiring Diagram*.

VACUUM / RECOVERY SYSTEM SERVICE MAINTENANCE CHECKLIST

Whenever there is a vacuum problem, it's best to check over the entire system. Use the checklist below as a guide, to thoroughly check the vacuum system.

- ☐ Clean built-up dirt from the inside of the squeegee tool.
- ☐ Replace the squeegee blades if they are nicked or torn.
- ☐ Inspect the hose between the squeegee tool and the recovery tank, rinse any built-up dirt from the hose. Replace the hose if it is kinked or damaged.
- ☐ Inspect and make sure the gasket on the recovery tank cover is sealing and not damaged.
- ☐ Inspect and clean the vacuum motor float cage.
- ☐ Make sure that the recovery tank drain hose cap seals airtight.

TROUBLESHOOTING GUIDE

If water flows around the ends of the squeegee tool, instead of being pulled into the tool, the vacuum system is not working properly. When a vacuum system performs poorly, it is usually because of one of the following problems:

Vacuum Leak(s) – Air flowing into the vacuum system past a bad gasket or leaky hose, damaged tank, or a leaky drain valve. A vacuum leak below the water line will create turbulence in the recovery tank, causing water to enter the vacuum motor.

Restriction(s) – Anything that blocks the flow of air through the system. Restrictions may also be caused by built-up debris in the squeegee tool, vacuum hoses, float cage or wherever the airflow is forced to make a sharp turn.

Both leaks and restrictions decrease the quantity of air flowing through the squeegee tool. The air that does go through the squeegee tool moves slower, so it has less pick-up power.

RECOVERY SYSTEM

TROUBLESHOOTING GUIDE ELECTRICAL

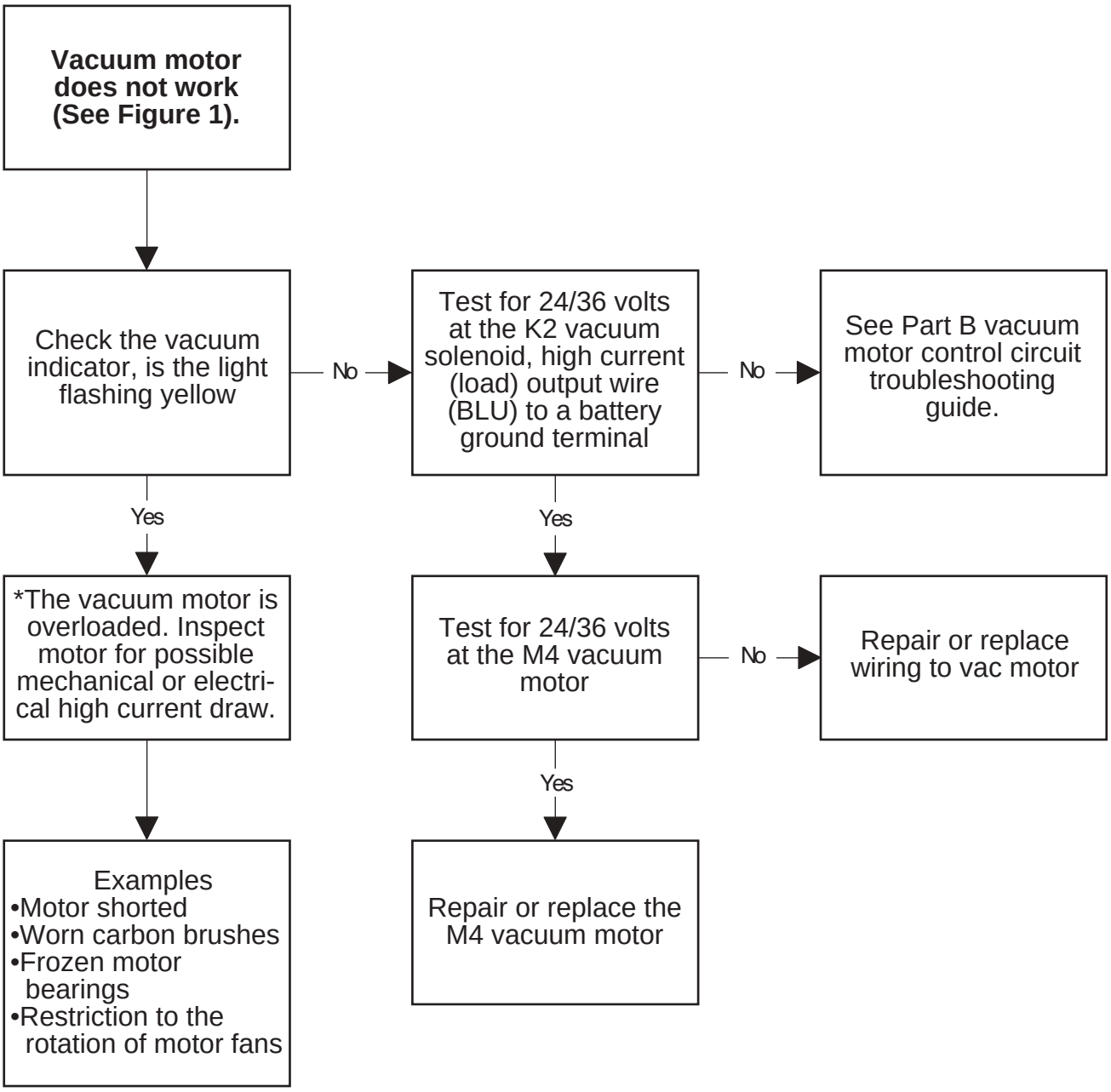
Possible Symptom

1 Vacuum motor will not run (auto mode)

SYMPTOM ONE

Note: Do all testing with key switch on, scrub on switch activated (scrub deck lowered) and drive paddle activated (pushed Fwd or pulled into Rev).
Note 2: Enter the Service Test Mode Program in the Electrical System manual section, for **alternate** machine troubleshooting procedures.

Part A: Vacuum Motor Load Circuit Troubleshooting Guide


Vacuum motor does not work (See Figure 1).
Check the vacuum indicator, is the light flashing yellow
No
Test for 24/36 volts at the K2 vacuum solenoid, high current (load) output wire (BLU) to a battery ground terminal
No
See Part B vacuum motor control circuit troubleshooting guide.
Yes
Yes
*The vacuum motor is overloaded. Inspect motor for possible mechanical or electrical high current draw.
Test for 24/36 volts at the M4 vacuum motor
No
Repair or replace wiring to vac motor
Yes
Examples
•Motor shorted
•Worn carbon brushes
•Frozen motor bearings
•Restriction to the rotation of motor fans
Repair or replace the M4 vacuum motor

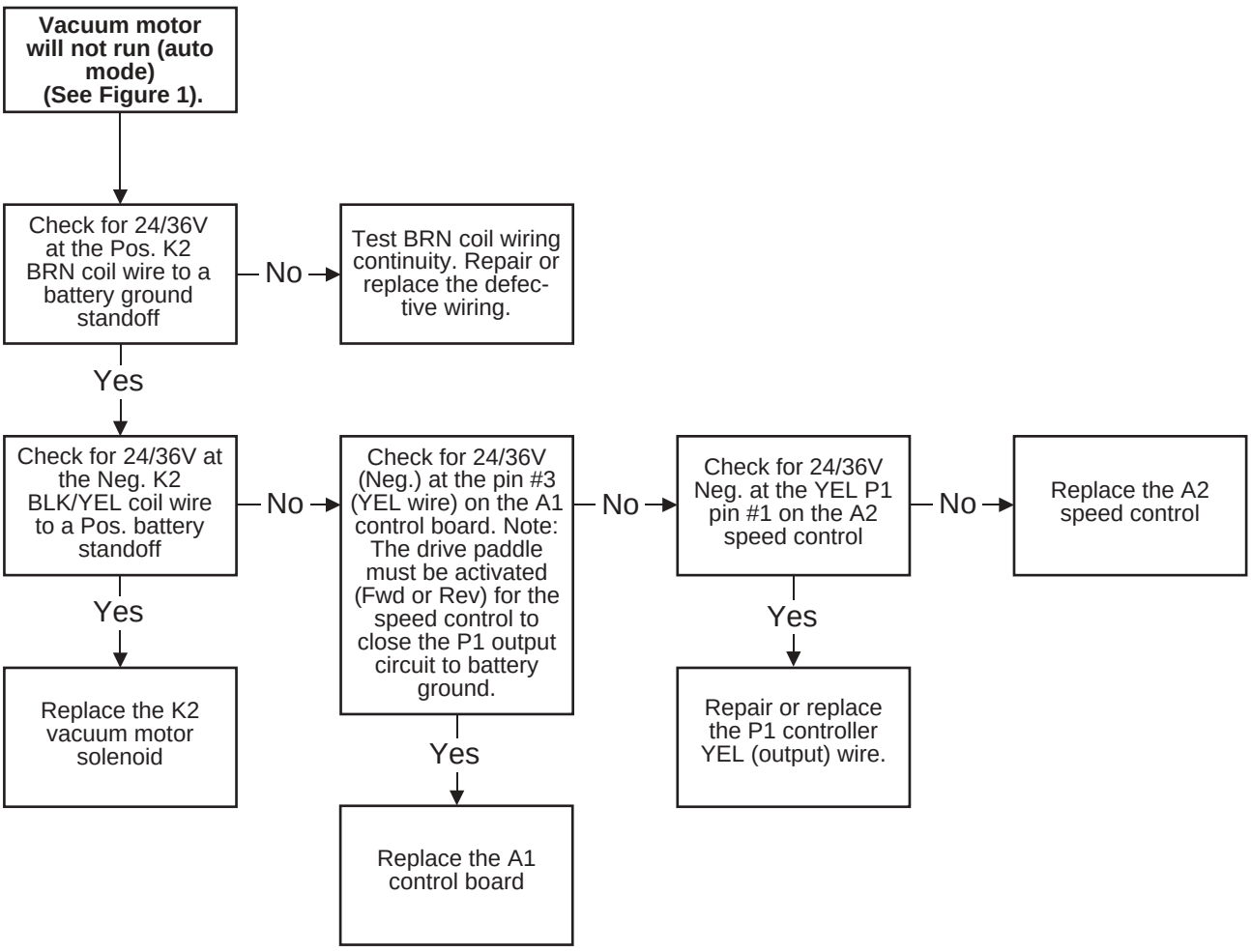
*If the vacuum motor becomes overloaded, the scrub, vacuum and solution systems will turn off and the indicator light will flash yellow at a fast rate (four times per second).

SYMPTOM ONE

Vacuum motor will not run (auto mode)

Note: Do all testing with key switch on, scrub on switch activated (scrub deck lowered) and drive paddle activated (pushed Fwd or pulled into Rev).

Part B: Vacuum Motor Control Circuit Troubleshooting Guide


Vacuum motor will not run (auto mode) (See Figure 1).
Check for 24/36V at the Pos. K2 BRN coil wire to a battery ground standoff
No
Test BRN coil wiring continuity. Repair or replace the defective wiring.
Yes
Check for 24/36V at the Neg. K2 BLK/YEL coil wire to a Pos. battery standoff
No
Check for 24/36V (Neg.) at the pin #3 (YEL wire) on the A1 control board. Note: The drive paddle must be activated (Fwd or Rev) for the speed control to close the P1 output circuit to battery ground.
No
Check for 24/36V Neg. at the YEL P1 pin #1 on the A2 speed control
No
Replace the A2 speed control
Yes
Replace the K2 vacuum motor solenoid
Yes
Replace the A1 control board
Yes
Repair or replace the P1 controller YEL (output) wire.

RECOVERY SYSTEM

MAINTENANCE OF FLOAT CAGE AND FLOAT DUCT

1 See Figure 3. Open the recovery tank dome lid and lay it to the side, remove the two **(A)** Screws and pull the Float Duct **(B)** and float cage assembly **(C)** from vac motor spacer **(D)**.
2 Snap apart the two float cage halves **(C)** and flush clean the float ball and cage pieces.
3 Inspect the Gasket **(E)** and clean any debris from the inside of the float duct housing. Then re-install all parts in reverse order.

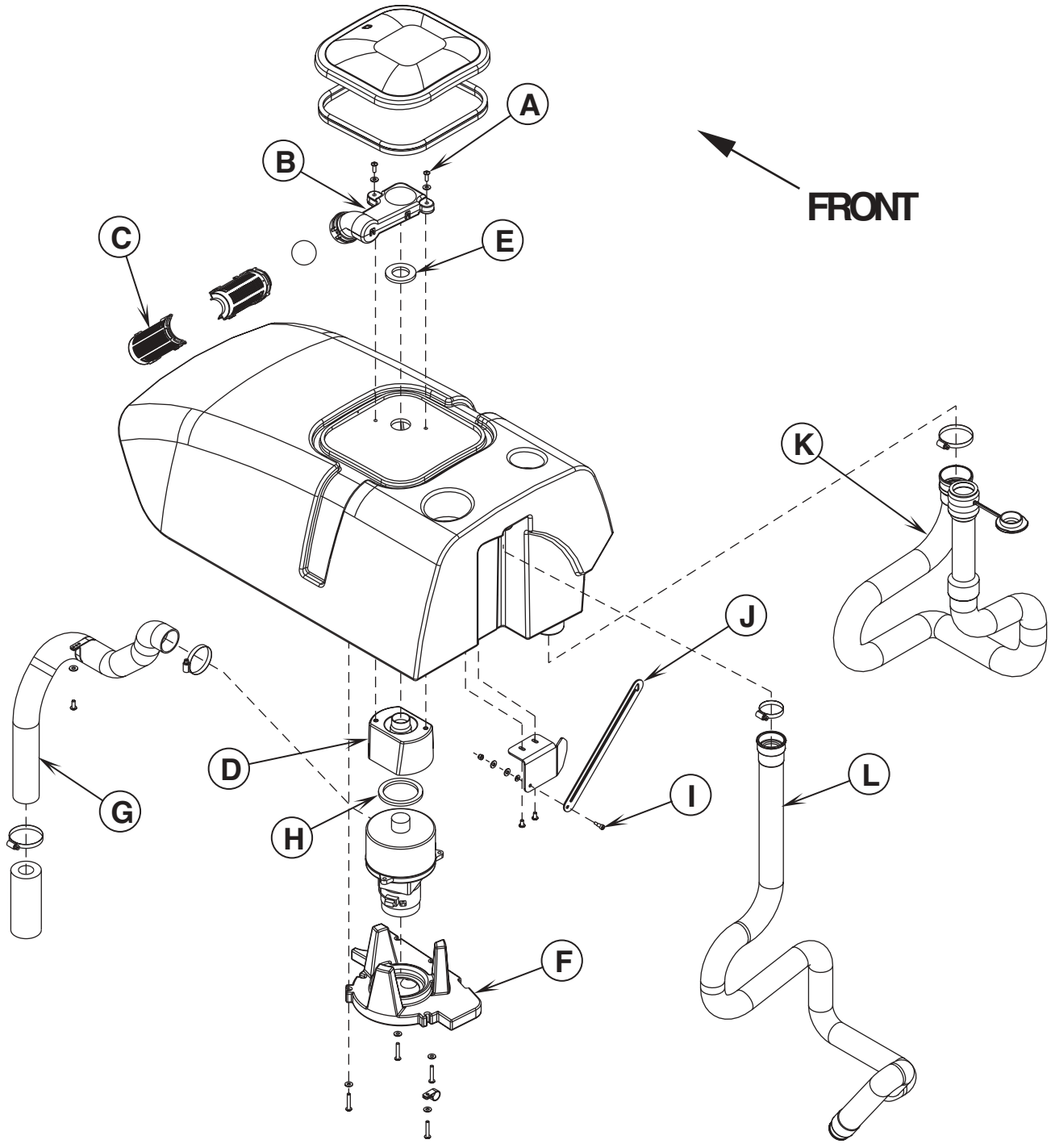
VACUUM MOTOR REMOVAL

1 Drain the recovery tank using the drain hose.
2 Swing open the recovery tank, secure with prop rod and disconnect the vacuum motor harness connector.
3 See Figure 3. Remove the vacuum motor Duct Cover **(F)** secured to the bottom of the recovery tank (qty 4 screws).
4 Loosen the exhaust hose clamp and remove Hose **(G)** from the vac motor discharge tube and completely remove the motor from its mount cavity.
5 Inspect the condition of the vac motor Gasket **(H)** inside the vac motor mount cavity.
6 Make service repairs to the vac motor and re-install by following steps in reverse order.

RECOVERY TANK REMOVAL

1 Follow steps 1-4 in the Vacuum Motor Removal section.
2 See Figure 3. Remove the Screw **(I)** and release the Tank Support Bar **(J)** and allow the tank to swing down to the side of the battery compartment box.
3 Loosen the hose clamp for the tank Drain Hose **(K)** and pull the hose free.
4 Remove the Squeegee Hose **(L)** from the tank connection.
5 Support the tank and remove the (4) screws from the hinge that attaches the tank to the top of the solution tank edge and pull the tank free from the machine.

FIGURE 3



SQUEEGEE SYSTEM

SQUEEGEE LIFT LINKAGE ADJUSTMENT

See Figure 2. The squeegee pick-up tool is raised and lowered manually by a rear control panel mounted lever.

Squeegee Lift Lever Adjustment

The squeegee tool's storage and operating positions are adjustable. To adjust:

1 Remove the recovery drain hose attached to the rear electrical control panel then remove the (6) screws securing the panel.
2 The squeegee Lift Link **(A)** has (4) mount holes for changing its length.
3 Remove the upper mounting hardware and assemble it in the hole that will allow a 1-inch distance from the squeegee tool rear blade to the floor, when the lift lever is raised.
4 Observe when the lever is lowered that the bottom of the lift link is free has a 1-inch space between the notch in the lower squeegee lift bracket. Note: This clearance is to allow the tool the proper movement to raise and lower (float) so the rear blade remains on the floor surface through normal adjustments and wear.

SQUEEGEE TOOL BLADE(S) REPLACEMENT

If the squeegee leaves narrow streaks or water, the blades may be dirty or damaged. Remove the squeegee, rinse it under warm water and inspect the blades. Reverse or replace the blades if they are cut, torn, wavy or worn.

To Reverse or Replace the Rear Squeegee Wiping Blade...

1 See Figure 2*. Raise the squeegee tool off the floor, then unsnap the Center Latch **(B)** on the squeegee tool.
2 Remove the Wing Nut **(C)** from each end of the squeegee, then remove the Tension Straps **(D)**.
3 Slip the Rear Blade **(E)** off the alignment pins.
4 The squeegee blade has 4 working edges. Turn the blade so a clean, undamaged edge points toward the front of the machine. Replace the blade if all 4 edges are nicked, torn or worn to a large radius.
5 Install the blade, following the steps in reverse order and adjust the squeegee.

To Reverse or Replace the Front Squeegee Blade...

1 Raise the squeegee tool off the floor, then loosen the (2) Thumb Nuts **(F)** on top of the squeegee and remove the squeegee tool from the mount.
2 Remove all the Hex Nuts **(G)** that hold the Front Blade **(H)** in place, then remove tension strap and blade.
3 The squeegee blade has 4 working edges. Turn the blade so a clean, undamaged edge points toward the front of the machine. Replace the blade if all 4 edges are nicked, torn or worn to a large radius.
4 Install the blade, following the steps in reverse order and adjust the squeegee.

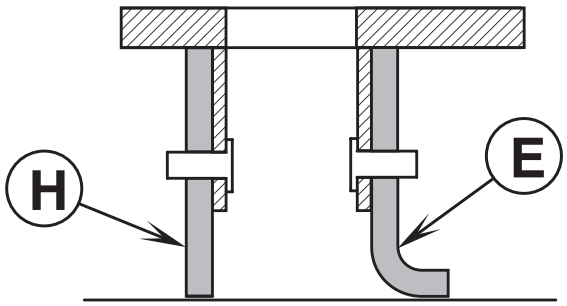
SQUEEGEE ADJUSTMENT

Adjusting the Squeegee Angle

Adjust the squeegee angle whenever a blade is reversed or replaced, or if the squeegee is not wiping the floor dry.

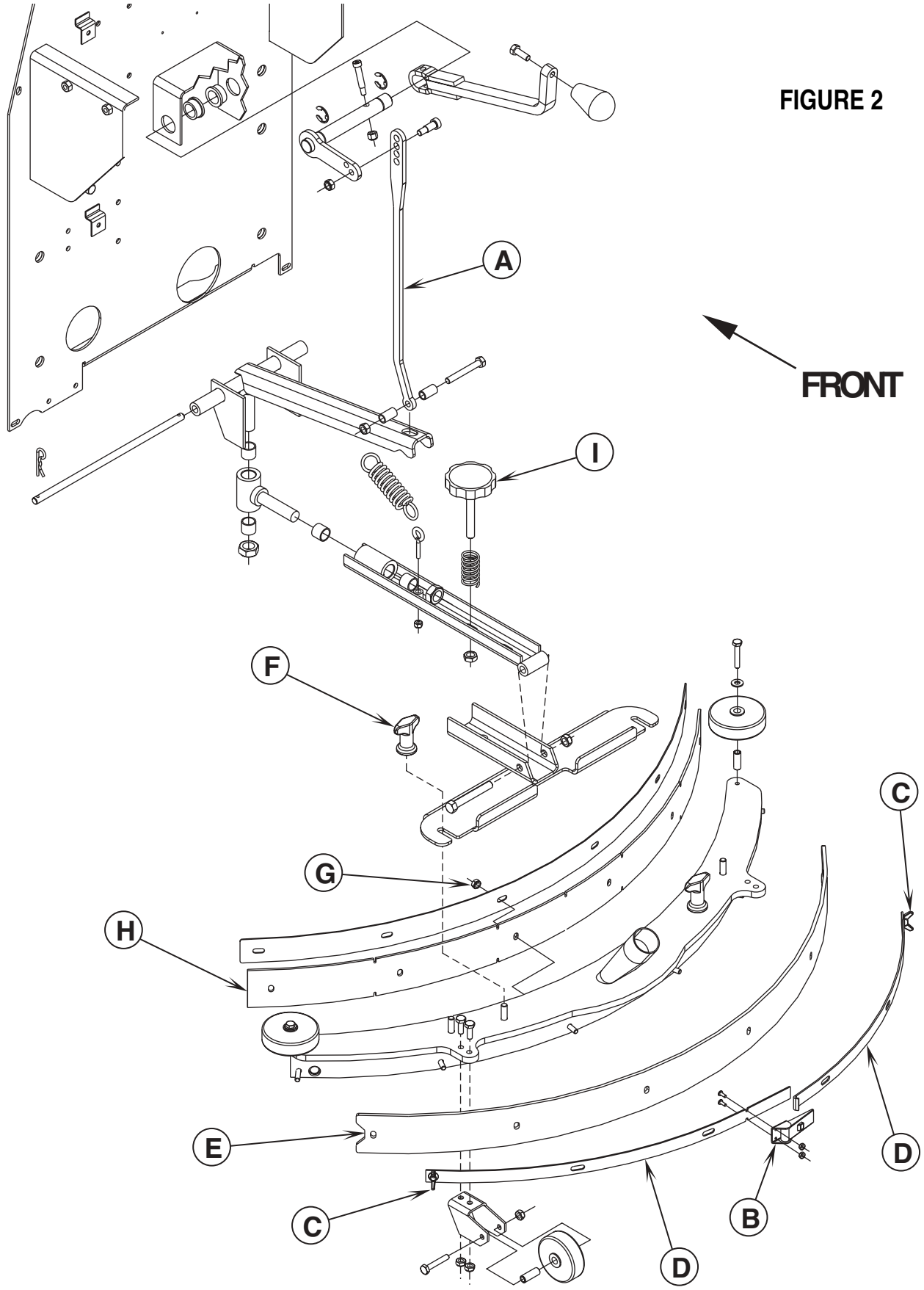
1 Park the machine on a flat, even surface and lower the squeegee. Push the machine forward enough to have the squeegee wiping blade fold over to the rear as shown in Figure 1.
2 See Figure 2*. Turn the Adjustment Knob **(I)** to tilt the tool forward (CCW) or backwards (CW), until the rear squeegee wiping blade touches the floor evenly across its entire width.

FIGURE 1



SQUEEGEE SYSTEM

FIGURE 2



***Note:** Figure 2 shows the squeegee tool for the CMAX™ 28ST, I-MAX™ 28C, BA 750ST, and BA 750C, the squeegee tool for the CMAX™ 34ST, I-MAX™ 32C, and BA 850ST are similar in adjustment and blade replacement.

WHEEL DRIVE SYSTEM

GENERAL FUNCTIONAL OVERVIEW

See Figures 1 and 3. A 1/2 horsepower permanent magnet (24V or 36V) motor (M1) is used for the wheel drive on all machines. The motor output is delivered to a single front mounted drive wheel driven by a chain as shown in Figure 3. A Curtis PMC solid state speed controller (A2) regulates the variable speed and Fwd/Rev wheel drive motor functions. Location of the controller is in the rear handle housing electrical compartment (accessible by removing the 4 screws securing the large rear electrical panel). The potentiometer R1 mounted in the drive paddle inputs to the A2 controller the machine operator's throttle (variable speed) and direction demands. A second pot R2 (knob adjusted) is mounted on the top surface of the handle housing and controls the machine's maximum transport and scrub speeds.

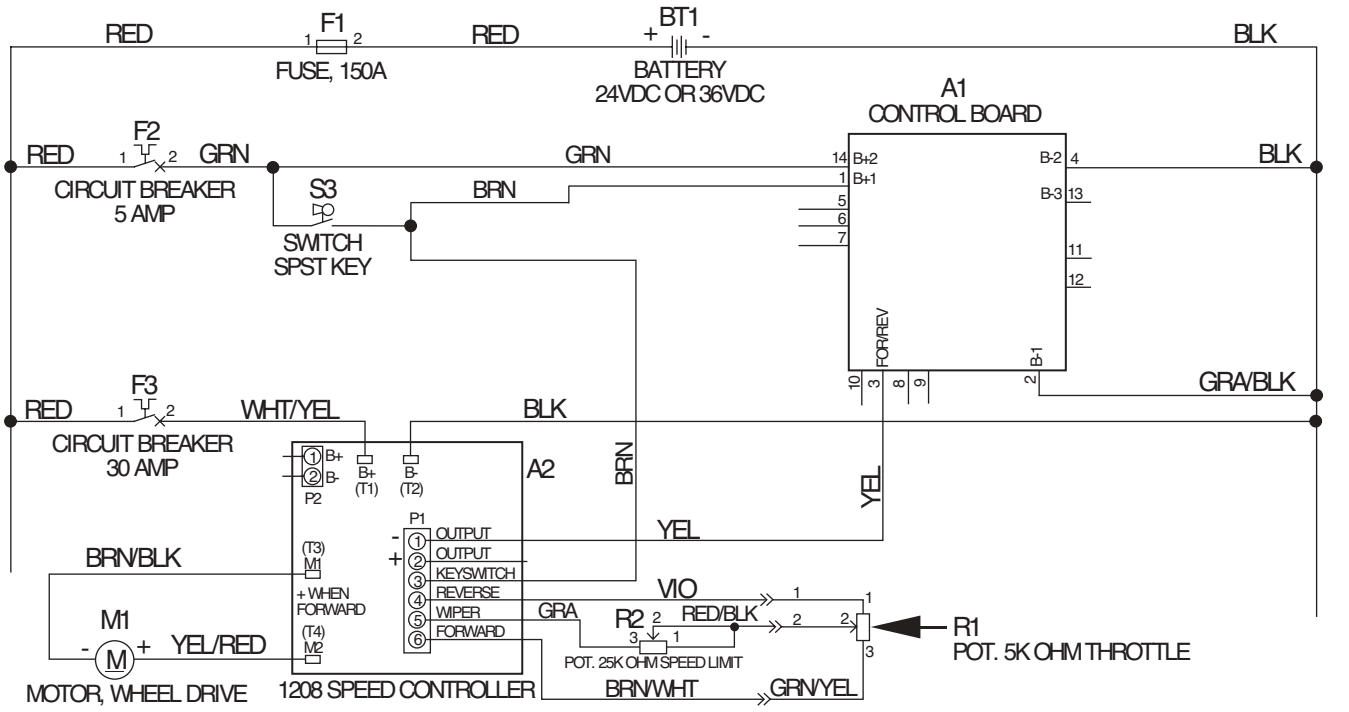
Drive Motor System Function

See Figures 1 and 2. With the key switch S3 closed the Brn wire inputs 24V or 36V to the A2 speed controller (terminal #3) to make its internal control circuits operational (powering it up). The F3 circuit breaker (30 Amp) supplies the positive load circuit voltage input to the B+ controller terminal (Wht/Yel wire). The black wire from the battery negative standoff supplies the (NEG.) input to the B- controller terminal.

Moving the 5K Ohm R1 pot off its centered balanced neutral setting of approximately 2500 Ohms, activates the operator input to the speed control. Forward or reverse movement of the drive paddle rotates the pot shaft and the pot's variable resistance value changes which generates the internal voltage signals (0-5Volts) needed for the controller's output operation. These control board voltage input signals are what energizes the Fwd and Rev directional relays, which then selects the motor polarity and final voltage level outputs at the M1 & M2 terminals.

When the operator turns the R2 speed limit Pot from min. to max. (CW) this causes an input resistance relationship change between the pot high (+) and wiper terminals (high to low Ohms) thus increasing the maximum wheel motor operating speed range. Turning the knob (CCW) increases the resistance and the motor speed range is reduced.

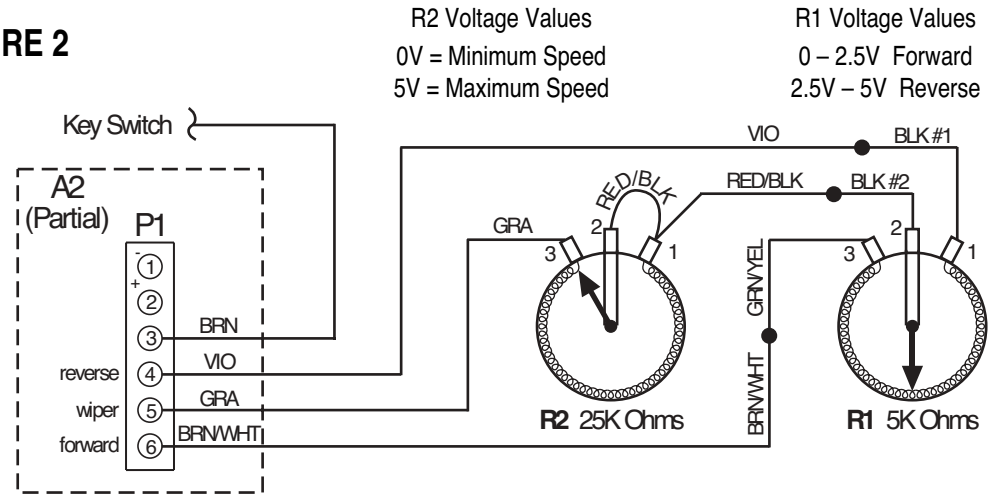
FIGURE 1



Electrical Diagram

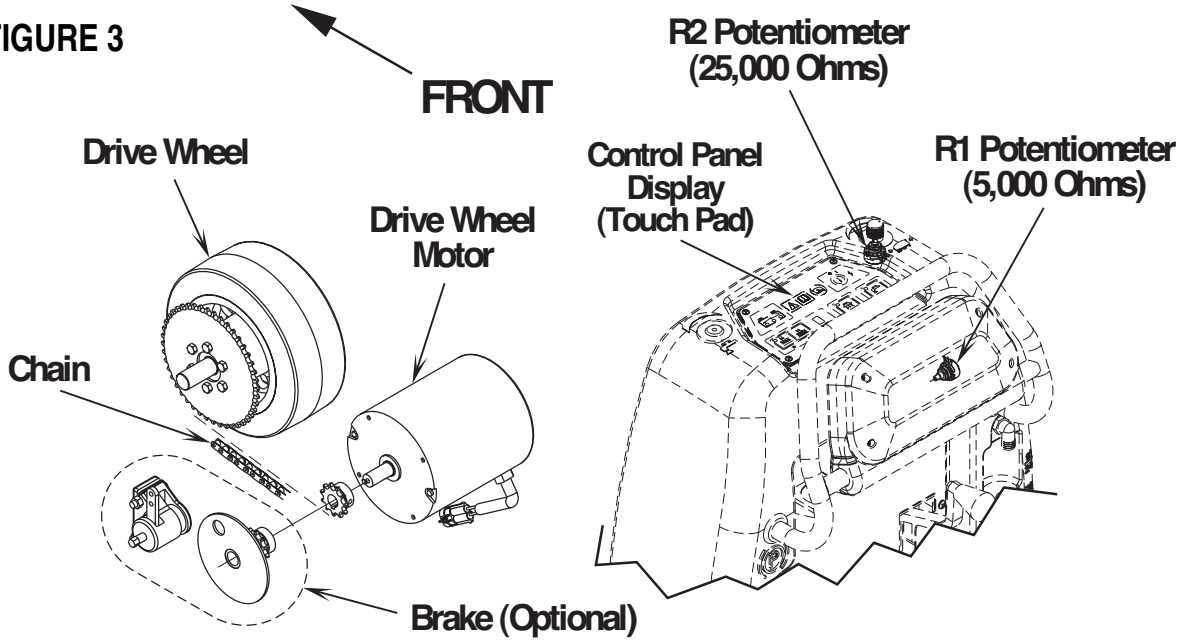
*For complete description of all callouts see Electrical System Wiring Diagram.

FIGURE 2



This drawing shows additional controller input circuit detail. The R2 pot is shown at the Max speed setting and the R1 pot in neutral.

FIGURE 3



WHEEL DRIVE TROUBLESHOOTING GUIDE

Problem	Possible Cause
• Wheel drive motor will not run in forward and reverse.	See Electrical Troubleshooting Flowcharts A & B in this section.
• Wheel drive in one direction only, loss of either forward or reverse.	Controller can't change electrical polarity to wheel motor. Replace the (A2) speed control.
• Machine creeps (moves) in forward or reverse with only the key switch ON.	• Check movement of the drive paddle spring centering device (auto dead-man return to neutral components). Repair or replace needed parts. • The R1 drive pot is out of adjustment. Reset to neutral the 5000 Ohm drive paddle potentiometer (*).
• During normal machine transporting the operator adjusts the R2 speed limit pot and there is no effect on the machine's speed output.	The R2 (25,000 Ohm) speed limiting pot wiper is either open where the machine runs at minimum speed or the pot wiper is shorted and runs at maximum speed. Before replacing the R2 pot (**), check for a loose/disconnected wire.

* See Potentiometer Installation and Adjustment instructions in this manual section and reset the (5K) pot to neutral.
** See 25K Wheel Drive Speed Limit Potentiometer Testing instructions in this manual system.

WHEEL DRIVE SYSTEM

TROUBLESHOOTING GUIDE ELECTRICAL

Possible Symptom

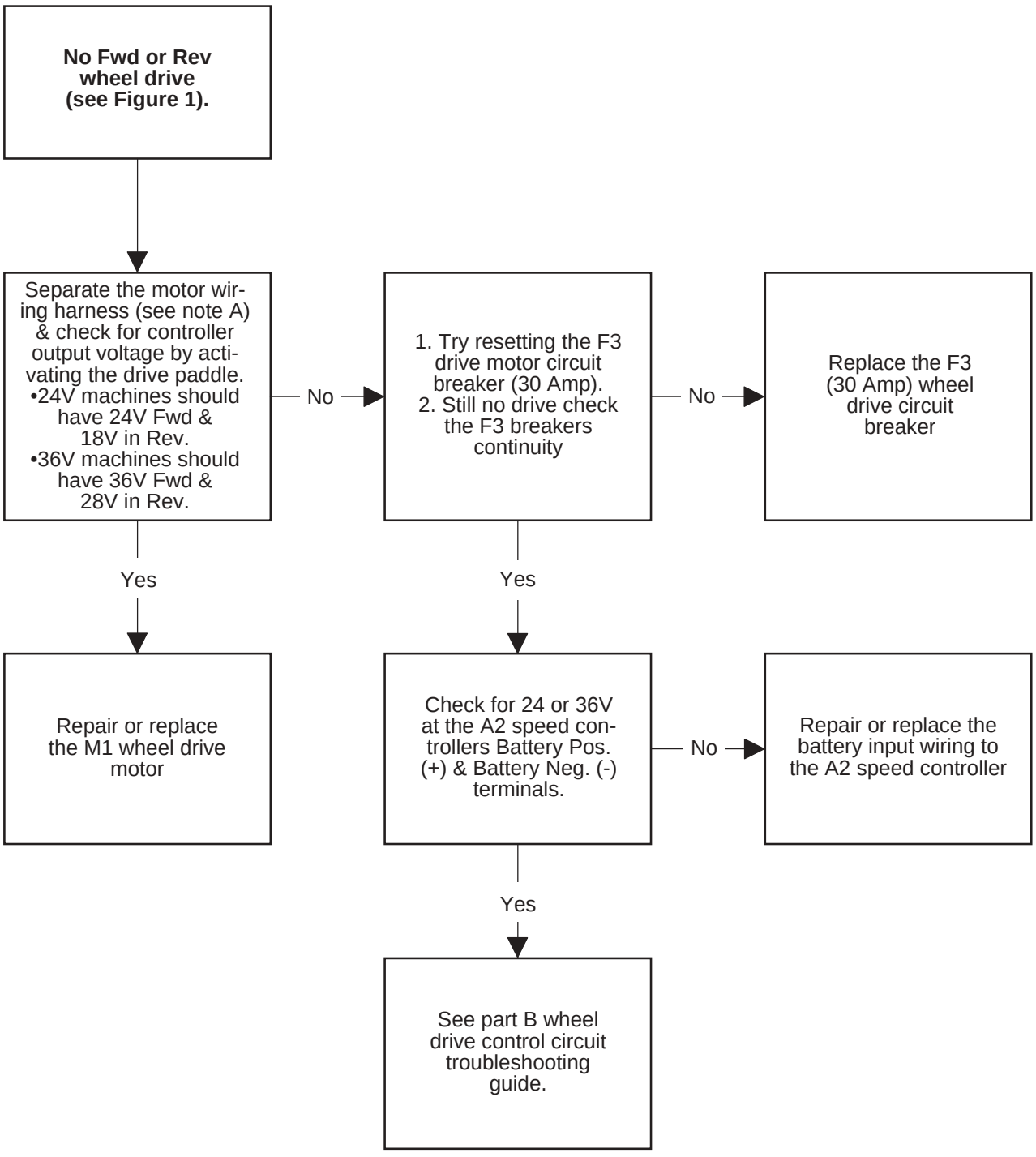
1 No forward and no reverse wheel drive

SYMPTOM ONE

Note: Do all testing with control panel R2 speed limiting pot in the maximum position, the drive wheel jacked up off the floor, key switch ON, and the drive paddle activated (pushed Fwd or pulled into Rev.)

Note 2: Enter the Service Test Mode Program in the Electrical System manual section, for **alternate** machine troubleshooting procedures.

Part A: Wheel drive system motor load circuit troubleshooting guide


No Fwd or Rev wheel drive (see Figure 1).
Separate the motor wiring harness (see note A) & check for controller output voltage by activating the drive paddle.
•24V machines should have 24V Fwd & 18V in Rev.
•36V machines should have 36V Fwd & 28V in Rev.
No
1. Try resetting the F3 drive motor circuit breaker (30 Amp).
2. Still no drive check the F3 breakers continuity
No
Replace the F3 (30 Amp) wheel drive circuit breaker
Yes
Repair or replace the M1 wheel drive motor
Yes
Check for 24 or 36V at the A2 speed controllers Battery Pos. (+) & Battery Neg. (-) terminals.
No
Repair or replace the battery input wiring to the A2 speed controller
Yes
See part B wheel drive control circuit troubleshooting guide.

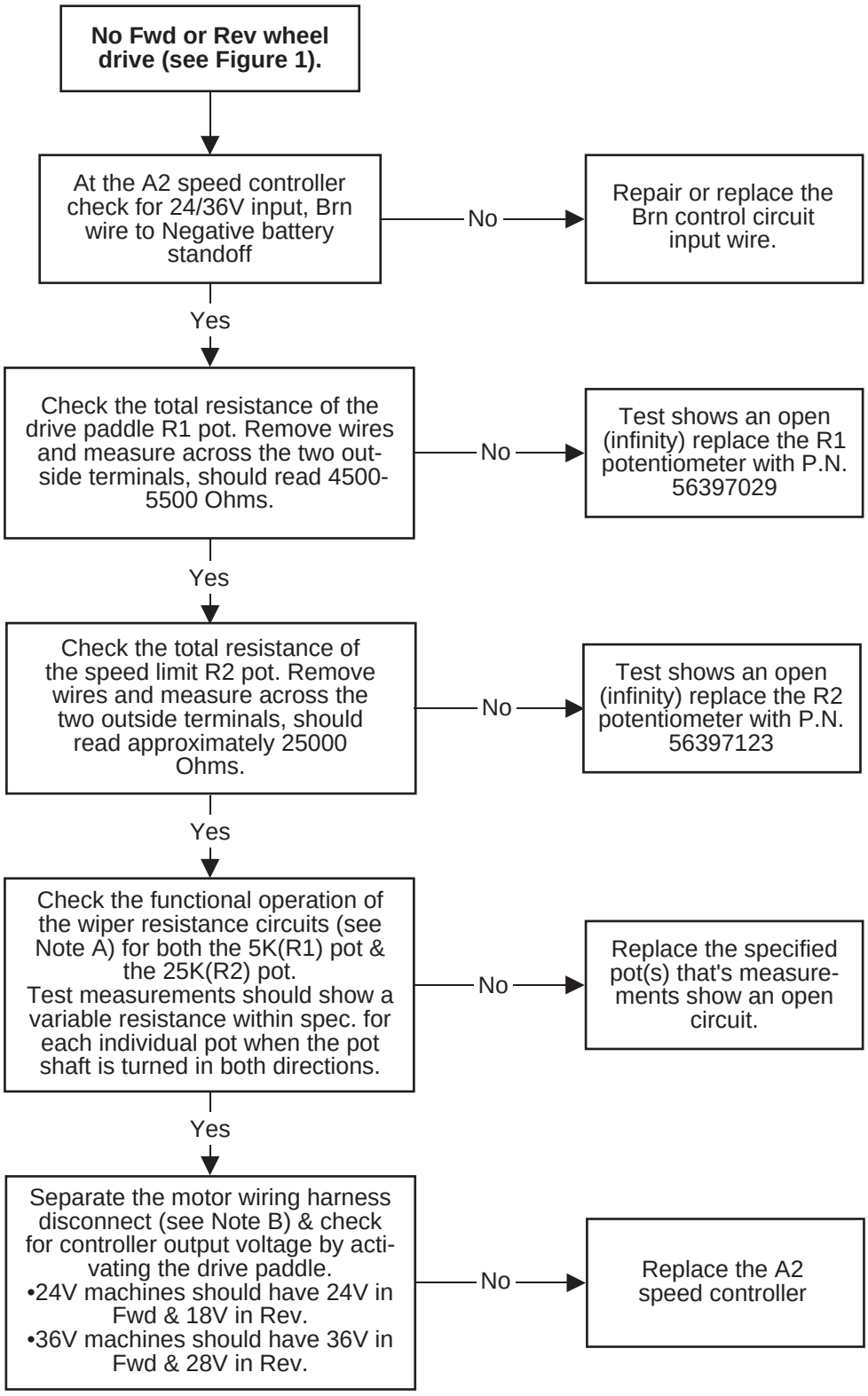
Note A: The drive wheel motor harness disconnect is located in the lower rear of the machine frame next to the right rear caster wheel.

TROUBLESHOOTING GUIDE ELECTRICAL (CONTINUED)

SYMPTOM ONE

Note: Do all testing with control panel R2 speed limiting pot in the maximum position, the drive wheel jacked up off the floor, key switch ON, and the drive paddle activated (pushed Fwd or pulled into Rev.)

Part B: Wheel drive system motor control circuit troubleshooting guide

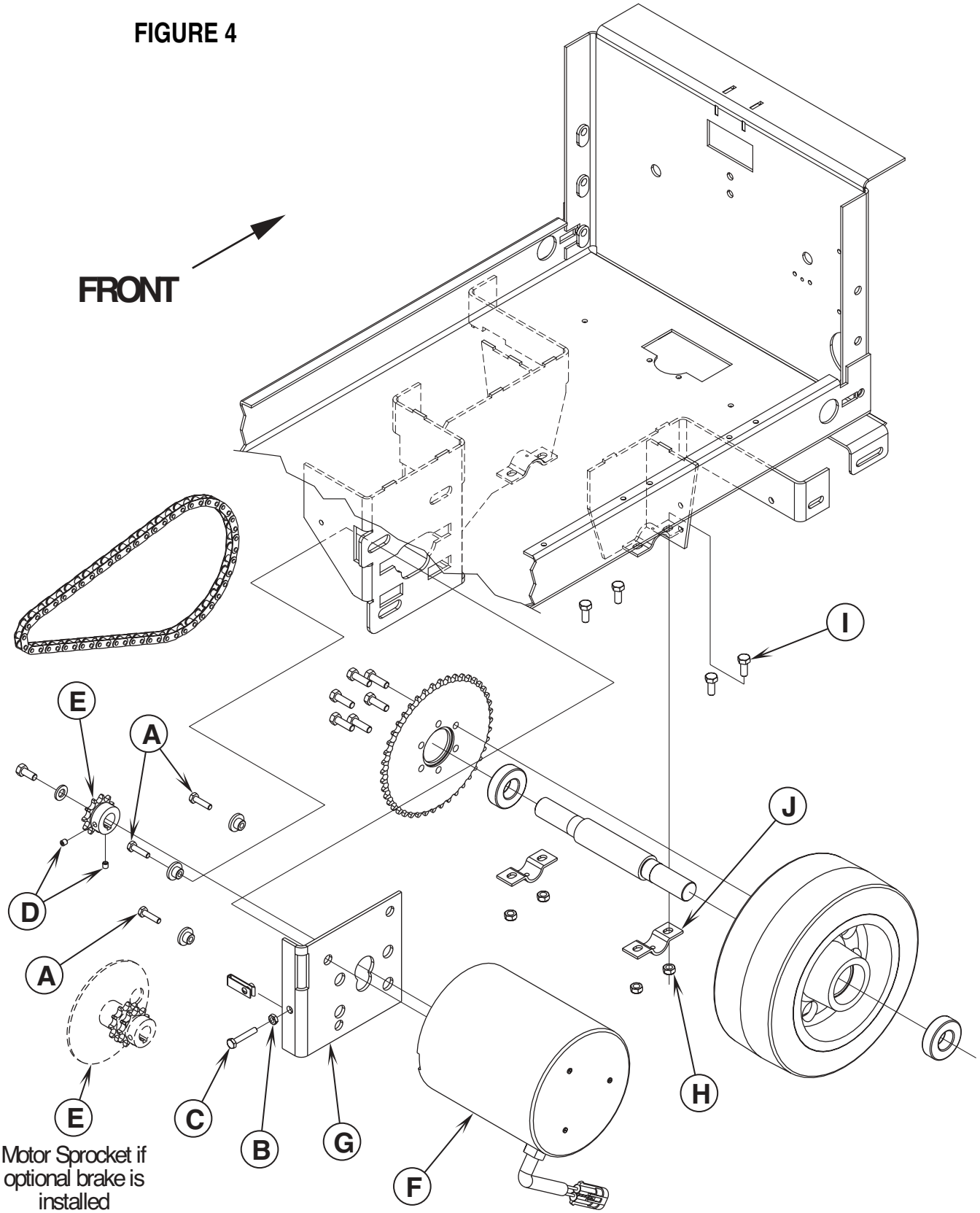

No Fwd or Rev wheel drive (see Figure 1).
At the A2 speed controller check for 24/36V input, Brn wire to Negative battery standoff
No
Repair or replace the Brn control circuit input wire.
Yes
Check the total resistance of the drive paddle R1 pot. Remove wires and measure across the two outside terminals, should read 4500-5500 Ohms.
No
Test shows an open (infinity) replace the R1 potentiometer with P.N. 56397029
Yes
Check the total resistance of the speed limit R2 pot. Remove wires and measure across the two outside terminals, should read approximately 25000 Ohms.
No
Test shows an open (infinity) replace the R2 potentiometer with P.N. 56397123
Yes
Check the functional operation of the wiper resistance circuits (see Note A) for both the 5K(R1) pot & the 25K(R2) pot.
Test measurements should show a variable resistance within spec. for each individual pot when the pot shaft is turned in both directions.
No
Replace the specified pot(s) that's measurements show an open circuit.
Yes
Separate the motor wiring harness disconnect (see Note B) & check for controller output voltage by activating the drive paddle.
•24V machines should have 24V in Fwd & 18V in Rev.
•36V machines should have 36V in Fwd & 28V in Rev.
No
Replace the A2 speed controller

Note A: Follow the potentiometer test instructions shown in the Wheel Drive System.

Note B: The drive wheel motor harness disconnect is located in the lower rear of the machine frame next to the right rear caster wheel.

WHEEL DRIVE SYSTEM

FIGURE 4



DRIVE MOTOR REMOVAL (ALL MODELS)

⚠ WARNING!

Disconnect the battery pack before servicing machine.

1 Remove the left side chassis panel to access the drive motor.
2 Disconnect the drive motor wiring connector.
3 See Figure 4. Loosen the (3) Motor Mount Bolts **(A)** then loosen the Lock Nut **(B)** and back out Adjustment Bolt **(C)** several turns to loosen the drive chain tension.
4 Remove the retainer clip from the chain's master link then separate and remove the chain from the sprockets.
5 Loosen both the Set Screws **(D)** from the drive motor Sprocket **(E)** then pull the sprocket off the motor shaft. Note use a 1/8" Hex socket to loosen the set screws.
6 Support the Drive Motor, remove the (3) Motor Mount Bolts **(A)** then remove the motor and the chain tensioner Bracket **(G)** from the machine.
7 Follow steps 1-6 in reverse order to reassemble, then refer to the chain adjustment section to retention the chain. Note: Make sure drive motor Sprocket **(E)** and the drive wheel sprocket are in alignment.

DRIVE WHEEL REMOVAL (CYLINDRICAL)

⚠ WARNING!

Disconnect the battery pack connector before servicing machine.

⚠ WARNING!

Never work under machine without safety stands or blocking to support the machine.

1 Drain both the solution and recovery tanks. Next remove the scrub deck debris hopper and have the scrub deck in the up (stored) position with the scrub brushes installed.
2 Place wood blocking in front and rear of both caster wheels to prevent the machine from rolling.
3 Remove the left and right side chassis panels and then remove the drive chain (follow instructions in the Chain Removal and Chain Adjustment section).
4 See Figure 4. Remove the two hardware items **(H** & **I)** from both front Axle Clamps **(J)** then loosen the two rear screws and nuts and swing the clamps to the rear.
5 Next shim the bottom of the brush deck housing in the middle (front to back) with wood blocking. Use blocking with approximate dimensions 3-1/2" wide, 2-1/4" thick and 15" long (9cm x 5.7cm x 38cm). Note: A standard 2x4 and 1x4 stacked on top of each other (together) will match the proper thickness (height) needed.
6 Next read the instructions for using the Service Test Mode steps 1-5 located in the electrical system manual section. Then enter the main controller diagnostic Service Test Mode.
7 See the Know Your Machine section control panel drawing. When in the service test mode press the Scrub On/Pressure Increase Button **(G)**. This switch circuit is used to control the output to the scrub deck lift actuator. Pressing and releasing this switch will cycle the actuator output, Up/Down and ON/OFF.
8 Activate the Switch **(G)** turning on the actuator where it runs to its down position and stops, then turn the key switch off and disconnect the batteries. This operating of the lift motor will raise the frame off the floor creating the needed clearance to remove the drive wheel. Roll the wheel forward then maneuver the wheel assembly out from the right side of the machine.

⚠ CAUTION!

When in the Service Test Mode don't press (activate) the Scrub Off/Pressure Decrease Switch **(H)** when the wood blocking is positioned under the scrub brushes as it will turn on the brush motors.

9 Make needed service repairs and re-install the drive wheel following the above steps in reverse order. Note: You must re-enter the Service Test Mode to raise the scrub deck up away from the floor.
10 Test-drive the machine for proper operation.

Important Service Notes: Listed below are alternate lifting methods that can be used to raise and lower the chassis to remove the drive wheel.

- Jack (raise) front of machine to where the drive wheel axle is able to clear the top wheel mount clamp bracket. Service Tip: Place a small hydraulic bottle jack or mechanical scissors jack underneath the front of the scrub deck in the middle.
- Shown in the Electrical System is the actuator power cord adapter PN 56407502 and instructions for use. This tool can be attached to the lift actuator (connector) for special output control to raise and lower the chassis with the placement of the above described wood blocking.

WHEEL DRIVE SYSTEM

DRIVE WHEEL REMOVAL (DISC)

⚠ WARNING!

Disconnect the battery pack connector before servicing machine.

⚠ WARNING!

Never work under machine without safety stands or blocking to support the machine.

1 Drain both the solution and recovery tanks. Next place the scrub deck in the up (stored) position, remove the splash guards and scrub brushes.

2 Place wood blocking in front and rear of both caster wheels to prevent the machine from rolling.

3 Remove the left and right side chassis panels and then remove the drive chain (follow instructions in the Chain Removal and Chain Adjustment section).

4 See Figure 4. Remove the two hardware items **(H** & **I)** from both front axle clamps **(J)** then loosen the two rear screws and nuts and swing the clamps to the rear.

5 Next shim the bottoms of the brush deck drive discs (left & right) with wood blocking. Use blocking with approximate dimensions 3-1/2" wide, 3" thick and 20" long (9cm x 7.6cm x 51cm). Note: Two standard 2x4s stacked on top of each other (together) will match the proper thickness (height) needed.

6 Next read the instructions for using the Service Test Mode steps 1-5 located in the electrical system manual section. Then enter the main controller diagnostic Service Test Mode.

7 See the Know Your Machine section control panel drawing. When in the service test mode press the Scrub On/Pressure Increase Button **(G)**. This switch circuit is used to control the output to the scrub deck lift actuator. Pressing and releasing this switch will cycle the actuator output, Up/Down and ON/OFF.

8 Activate the Switch **(G)** turning on the actuator where it runs to its down position and stops, then turn the key switch off and disconnect the batteries. This operating of the lift motor will raise the frame off the floor creating the needed clearance to remove the drive wheel. Roll the wheel forward then maneuver the wheel assembly out from the right side of the machine.

⚠ CAUTION!

When in the Service Test Mode don't press (activate) the Scrub Off/Pressure Decrease Switch **(H)** when the wood blocking is positioned under the scrub brushes as it will turn on the brush motors.

9 Make needed service repairs and re-install the drive wheel following the above steps in reverse order. Note: You must re-enter the Service Test Mode to raise the scrub deck up away from the floor.

10 Test-drive the machine for proper operation.

Important Service Notes: Listed below are alternate lifting methods that can be used to raise and lower the chassis to remove the drive wheel.

- Jack (raise) front of machine to where the drive wheel axle is able to clear the top wheel mount clamp bracket. Service Tip: Place a small hydraulic bottle jack or mechanical scissors jack underneath the front of the scrub deck in the middle being careful not to damage solution fittings.
- Shown in the Electrical System is the actuator power cord adapter PN 56407502 and instructions for use. This tool can be attached to the lift actuator for special output control to raise and lower the chassis with the placement of the above described wood blocking.

CHAIN MAINTENANCE

- Every two months check the chain tension, 1/2 inch (13mm) deflection at mid point.
- Once a month check chain for binding and dryness, apply oil to lube the chain links.
- Yearly remove chain, clean and re-oil.

CHAIN REMOVAL AND CHAIN ADJUSTMENT

Chain Removal

⚠ WARNING!

Disconnect the battery pack connector before servicing.

1 See Figure 4. Loosen the (3) Motor Mount Bolts **(A)**. Note: If equipped with the optional parking brake, insert a 7/16" standard socket and extension bar through the brake rotor access hole. Rotate the brake rotor to access and align the socket wrench with each individual mounting bolt.

2 Loosen the Lock Nut **(B)** and back out the adjustment Bolt **(C)** several turns to help release the chain tension.

3 Remove the retainer clip from the chain's master link, then separate and remove the chain from the sprockets.

4 Install a new chain and reconnect the master link and adjust chain tension (follow Chain Adjustment instructions). Service Tip: Push or pry the motor forward to shorten the distance between the sprockets to make it easier to reconnect the master link.

CHAIN REMOVAL AND CHAIN ADJUSTMENT (CONTINUED)

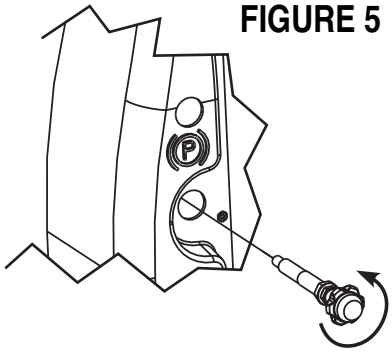
Chain Adjustment

1 Loosen the (3) Motor Mount Bolts **(A)** and the adjustment Lock Nut **(B)** to adjust chain tension.
2 Turn the adjustment Bolt **(C)** in (CW) to obtain a 1/2" (13mm) chain deflection between the sprockets when moderate pressure is applied to the chain.
3 Retighten the adjustment bolt lock nut, the (3) motor mount bolts and test the drive system for proper operation.

OPTIONAL PARKING BRAKE OPERATION

1 See Figure 5. To set the parking brake press the center of the brake assembly handle and at the same time grip the outside knob then pull backwards and release.
2 Next turn the knob CCW to tighten the cable for a firm brake caliper to rotor engagement.
3 To release the parking brake, press the end of the handle and push in.

FIGURE 5



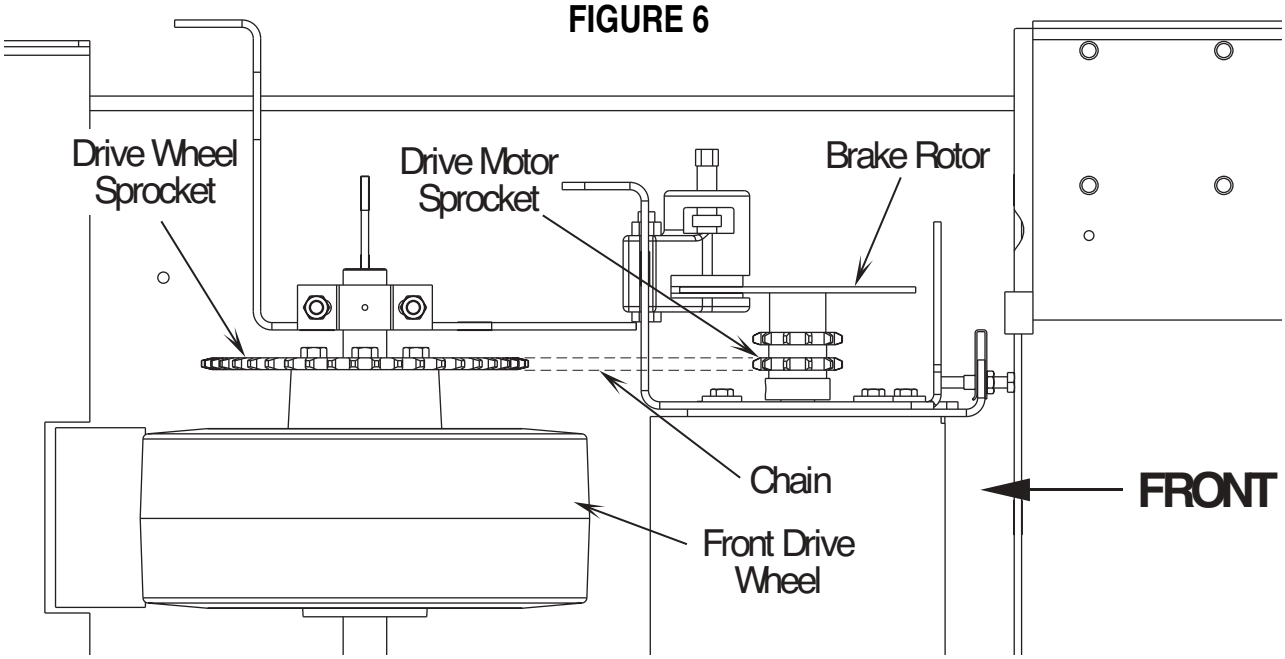
OPTIONAL BRAKE - ASSEMBLY REMOVAL

⚠ WARNING!

Disconnect the battery pack before servicing the machine.

1 Remove the left side chassis panel to access the parking brake components.
2 Remove the bolt and nut that secure the brake cable at the brake caliper arm.
3 Separate the drive chain by removing the master link.
4 See Figure 4. Rotate the brake rotor/sprocket assembly **(E)** to a working position to access the (2) 1/4-20 set screws. Loosen both the Set Screws **(D)** using a 1/8" Hex socket then pull the caliper and rotor assembly off the end of the drive motor shaft.
5 Follow the above steps in reverse order to reassemble. Note: Make sure the drive brake rotor/drive sprocket and drive wheel sprocket are in alignment to prevent binding and excessive wear.

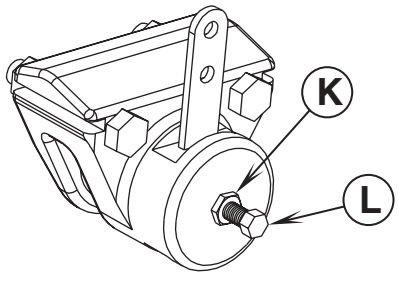
FIGURE 6



OPTIONAL BRAKE - CALIPER ADJUSTMENT

1 See Figure 7. Loosen the large outer Nut **(K)**, then turn the inner caliper adjustment Screw **(L)** in to compensate for pad wear. Note: Do not over adjust to the point that the pad drags excessively against the brake rotor. After making the adjustment test the parking brake for proper operation both set and released.

FIGURE 7



WHEEL DRIVE SYSTEM

5K POTENTIOMETER TESTING AND REMOVAL

⚠ WARNING!

Disconnect batteries at the battery pack disconnect before servicing.

Testing the 5K Potentiometer

Note: The potentiometer (pot) doesn't have to be removed from its housing mount to test.

1 See Figure 8. Remove the front drive paddle Cover **(M)** from the rear housing **(N)** held together with (4) item **(O)** Screws.

2 See Figure 9. Observe the 3 wires connected to the pot and disconnect. Note the proper wire numbers and/or colors and their terminal connections for re-assembly.

3 Test the Pot **(P)** using an ohmmeter, the potentiometer specification is 5K Ohms. Connect the meter leads to each of the outside connections (3 high & 1 low, shown in Figure 9) on the pot, it should read approximately 5000 ohms (range 4500-5500 ohms).

4 Next, take the 3 high pot connection test lead and connect to the middle connection (2 wiper), then push and pull the rear cover to turn the shaft in both directions. The readings should be approximately half the total resistance (2500 ohms) towards 5000 ohms and 2500 ohms towards 0 ohms. Example "A" total resistance of pot 4840 ohms (3 high/1 low) test connections. Example "B" test middle connection (2 wiper) and outside rear (1 low) Fwd reading 2420 ohms to 4700 ohms, Rev 2420 ohms to 230 ohms.

5 Testing Summary: The above tests are to show the increase and decrease of the pot through its working range. If you do not get similar readings replace the Potentiometer **(P)**.

Potentiometer Removal

6 See Figure 10. Loosen the pot shaft anchor nut and unthread it to the end of the shaft.

7 Back out the Screw **(Q)** from the pot Fork **(R)**.

8 Maneuver the pot out from its mounting bracket hole and separate the Fork **(R)** from the shaft end.

9 Finish unthreading the anchor nut from the end of the pot and then remove the pot completely from the handle mount.

10 To reinstall a potentiometer see the adjustment section below in this manual section.

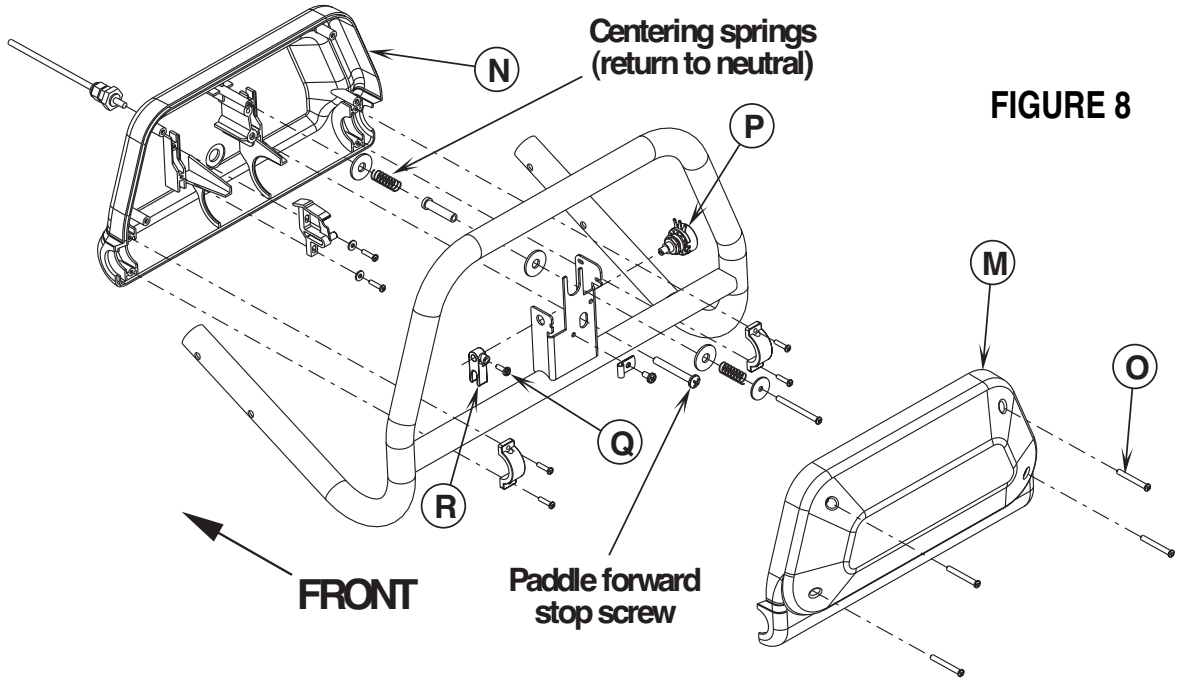


FIGURE 8

POTENTIOMETER INSTALLATION AND ADJUSTMENT

⚠ WARNING!

The adjustment of the potentiometer is to set the drive paddle for a neutral drive motor operation. If the potentiometer is not adjusted properly, the machine could move on its own, in either FWD or REV without any operator input.

1 See Figure 10. Install lock washer (on pot side), pot and anchor nut to the handle mount bracket as shown. NOTE: Do not completely tighten the anchor nut at this time.

2 Using an ohmmeter connect leads to the middle terminal (2 wiper) and the (1 low pot) outside terminal. Then pre-set, turn the shaft to approximately 2500 ohms.

3 Install the Fork **(R)** onto the pot shaft, then tighten the **(Q)** Screw.

4 Then without turning the pot shaft thread the anchor nut just enough to seat the pot to its mounting bracket.

POTENTIOMETER INSTALLATION AND ADJUSTMENT (CONTINUED)

5 Reconnect the ohmmeter test leads to the pot wiper and low terminal connections and adjust (turn the pot) to obtain half of pot's total resistance. This will accurately set the true neutral drive paddle operator position.

6 Tighten the anchor nut secure. Note: Do not turn the potentiometer shaft when tightening. Reconnect the battery connector and turn the key switch on and test the drive system for proper FWD and REV operations. Note: The dash panel maximum speed control knob should be turned to the full speed position for testing.

FIGURE 9

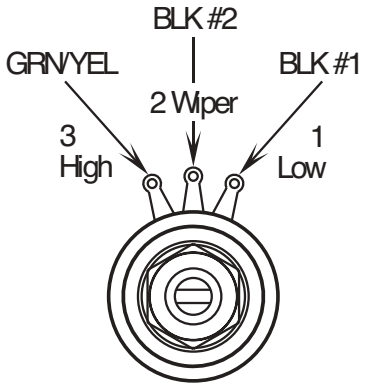
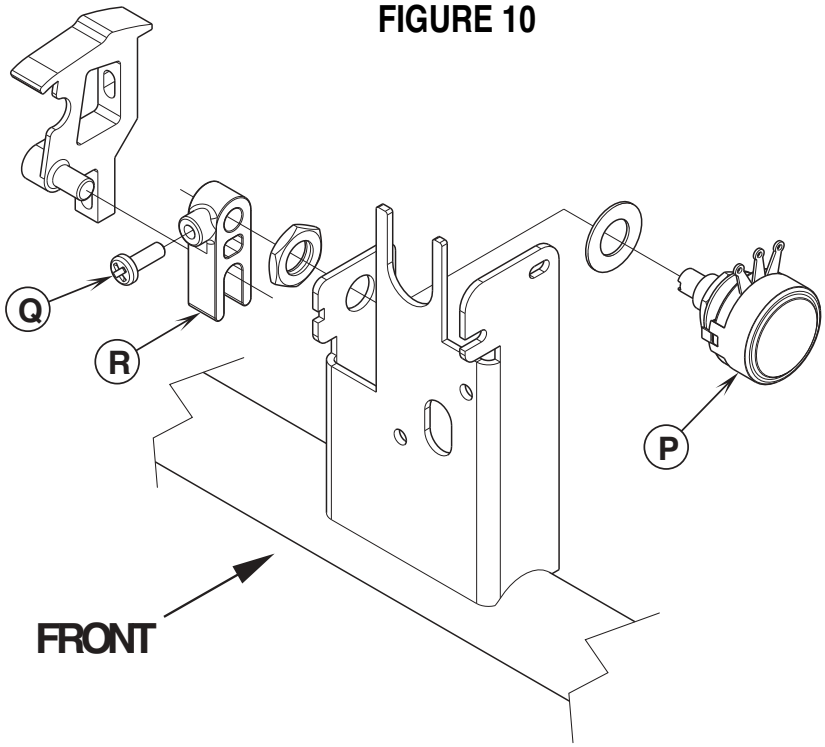


FIGURE 10



25K WHEEL DRIVE SPEED LIMIT POTENTIOMETER TESTING

⚠ WARNING!

Disconnect the battery connector before servicing.

Note: The potentiometer (pot) should be removed from the handle housing to easily test.

1 See Figure 11. Remove the Set Screw **(S)** (5/64" wrench) and pull off the Adjustment Knob **(T)** from the stem of the pot.

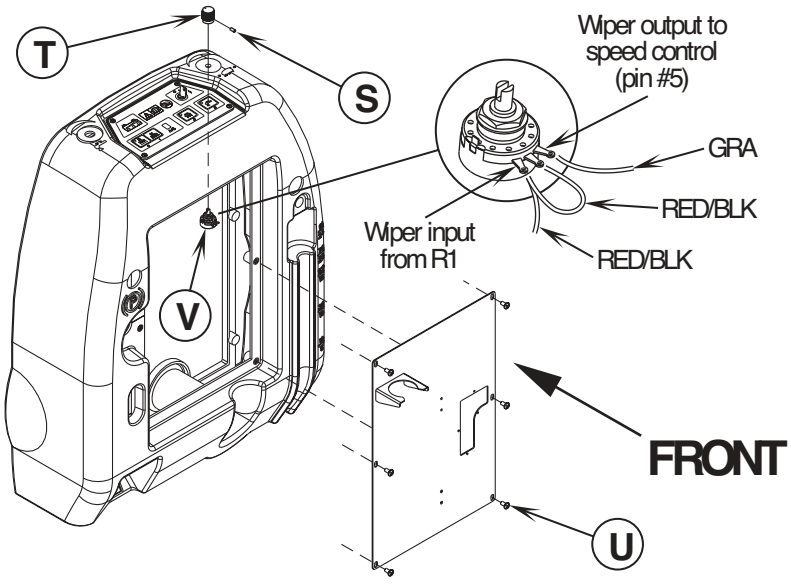
2 Remove the rear electrical access panel secured with (6) Screws **(U)**.

3 Remove the pot's anchor nut (1/2 inch wrench) then pull the Pot **(V)** and wires out from the electrical compartment.

4 Observe the proper wire colors and their correct terminal connections to re-assemble.

5 Disconnect all three wires and test the potentiometer **(V)** using an ohmmeter. The specification is 25,000 ohms. Connect the meter leads to each of the outside connections on the potentiometer, should read approximately 25,000 ohms. Next, take one of the test leads and connect to the middle terminal, then turn the stem both directions. The resistance value will change (vary) increasing and decreasing through its full range of 0-25,000 ohms and 25,000-0 ohms approximately. If you do not get similar readings replace the potentiometer.

FIGURE 11



ELECTRICAL SYSTEM

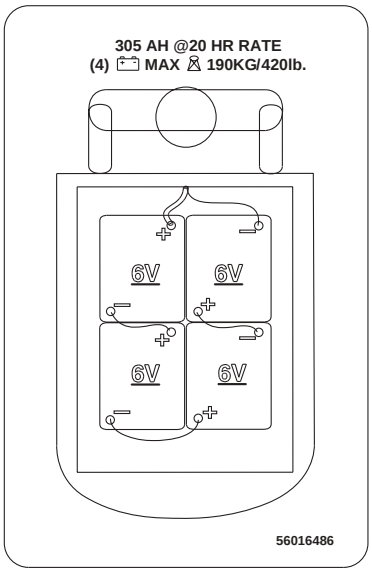
BATTERY SPECIFICATIONS

- Use a combination of multiple 2-volt cell units to construct a 24 or 36 Volt DC battery pack system.
- Nilfisk-Advance recommended battery pack capacity is a 238 AH @ 20 Hour Rate deep cycle battery system. Note: The battery pack must fit the battery compartment size listed in Specifications.

BATTERY CHARGER SPECIFICATIONS

- Use a 24 or 36 Volt DC output charger matching the DC battery pack voltage and the input AC line voltage supply being used.
- Always when selecting a battery charger follow the recommendation of the battery supplier to match the proper charger DC output amperage to the amp/hour rating batteries being installed. This will prevent the battery pack from being over or under charged.
- The recommended 238 AH battery should be matched to a 24V, 25 Amp output charger on machines using (4) batteries and a 36V, 25 Amp charger on machines using (6) batteries.

FIGURE 1



INSTALL THE BATTERIES

⚠ WARNING!

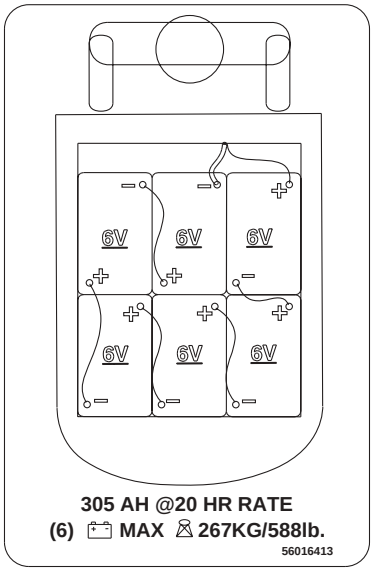
Use extreme caution when working with batteries. Sulfuric acid in batteries can cause severe injury if allowed to contact the skin or eyes. Explosive hydrogen gas is vented from inside the batteries through openings in the battery caps. This gas can be ignited by any electrical arc, spark or flame.

When Servicing Batteries...

- Remove all jewelry.
- Do not smoke.
- Wear chemical goggles, rubber gloves and a protective apron.
- Work in a well-ventilated area.
- Do not allow tools to touch more than one battery terminal at a time.

⚠ CAUTION!

Electrical components in this machine can be severely damaged if the batteries are not installed and connected properly. Batteries should be installed by Nilfisk-Advance or by a qualified electrician.



1 Remove the batteries from their shipping crate and carefully inspect them for cracks or other damage. If damage is evident, contact the carrier that delivered them or the battery manufacturer to file a damage claim.

2 Turn the Master Key Switch (**B**) OFF and remove the key.

3 Tip the recovery tank to the side, locked position. Remove the battery cables from inside the battery compartment.

4 Your machine comes from the factory with enough battery cables to install four or six (6 volt), 305 Amp hour batteries. Carefully lift the batteries into the battery compartment and arrange them exactly as shown. Secure the batteries as close to the back of the machine as possible.

5 The terminals on the battery cables are marked "+" for positive and "-" for negative. Install the battery cables as shown, with the terminals marked "+" on the positive battery terminals and the terminals marked "-" on the negative terminals. Position the cables so the battery caps can be easily removed for battery service.

6 Carefully tighten the nut in each battery terminal until the terminal will not turn on the battery post. Then tighten the nut one additional turn. Do not over-tighten the terminals, or they will be very difficult to remove for future service.

7 Coat the terminals and posts with spray-on battery terminal coating (available at most auto parts stores).

8 Put one of the black rubber boots over each of the terminals.

DESCRIPTION OF THE BATTERY LOW VOLTAGE CUTOUT FEATURE

All models discussed in this manual are equipped with a low voltage cutout feature to prevent over-discharging of the batteries. When a machine's battery pack voltage falls below specifically defined thresholds (voltage settings) the scrub system is automatically shut down. The cutout level is adjustable. The standard lead acid battery (wet cell) setting is 1.72V per cell and alternate maintenance free battery (gel cell) setting is 1.81V per cell. The standard setting is factory selected and should be used unless the battery manufacturer specifies the higher cutout voltage.

Special Service Note: On all the 24V & 36V machines a minimum recharge voltage of 2.09 volts per cell must be reached to allow the scrub brush and solution system to (reset) function again. A 24V-battery pack must increase to a 25.1-volt minimum and a 36V battery pack to 37.6 volts.

DESCRIPTION OF THE BATTERY CONDITION INDICATORS

The Battery Condition Indicator **(J)** will give an indication of the state of charge of the batteries. The battery condition indicator will retain the state-of-charge even if the key has been turned off. The state-of-charge indication is reset to full charge when the batteries have been recharged. It is also possible to choose between two different low voltage thresholds depending on whether maintenance free or standard batteries are being used **(have qualified service engineer perform this selection*)**. NOTE: The following percentages are based on useable battery capacity not total battery capacity. Therefore, 100% discharge = 80% of total battery capacity for standard wet cell batteries or 70% of total battery capacity for maintenance free batteries.

Explanation of Battery Indicator Lights and Voltage Ranges

Battery Indicator	% of Discharge	36 volt machines		24 volt machines	
		Standard	Alternate	Standard	Alternate
Green	Full to 50%	34.0+	34.5+	22.6+	23.0+
Green & Yellow	50% to 75%	33.0-34.0	34.0-34.5	22.0-22.6	22.6-23.0
Yellow	75% to 90%	32.0-33.0	33.5-34.0	21.3-22.0	22.3-22.6
Yellow & Red	90% to 95%	31.5-32.0	33.0-33.5	21.0-21.3	22.0-22.3
Red	95% to 99%	31.0-31.5	32.5-33.0	20.6-21.0	21.6-22.0
Flashing Red/Cutoff	100%	<31.0	<32.5	<20.6	<21.6

***Important Note:** See the Main Control Board Special Program Options manual section (located in the Electrical System) and follow the instructions for changing the low voltage cutout threshold.

CHARGING THE BATTERIES

Charge the machine's battery pack each time the machine is used, or when the Battery Condition Indicator **(J)** is showing red flashing indicator lights. Note: The machine also uses a special low voltage cutout that inhibits the scrub system see in this manual section the description for the low voltage cutout feature.

To Charge the Batteries...

1. Drain the recovery tank, next lift open the hinged tank setting the prop rod. Locate the machine/battery pack connector assembly **(9)**.
2. Pull up (separate) the top removable battery pack connector half then push together both the battery charger and battery pack connectors.
3. Follow the instructions on the battery charger.
4. Check the fluid level in all the battery cells **after** charging the batteries. Add distilled water, if necessary, to bring the fluid level up to the bottom of each battery cells filler tubes.

⚠ WARNING!

Do not fill the batteries before charging. Only charge batteries in a well-ventilated area. Do not smoke while servicing the batteries.

BATTERY MAINTENANCE

Proper maintenance of electric vehicle batteries can greatly extend their life. Well-maintained batteries may last up to 3 years, but failure after 1 year is common if maintenance has been poor.

There are 3 simple rules for good battery maintenance:

- **Maintain Proper Electrolyte Level (Weekly)** - Use distilled water in batteries whenever possible. If batteries are discharged, add just enough water to cover the plates in each cell. If batteries are fully charged, fill each cell to the bottom of the filler tube. **Do not over-fill the batteries! Do not add acid to batteries!**
- **Keep the Batteries Charged (Weekly)** - Batteries should be charged each time that a machine is used for more than 1 hour. Machine operators should open the battery compartment cover for charging, to avoid a concentrated build-up of hydrogen gas. Operators should follow the instructions provided with their specific battery charger, to determine how long the batteries should be charged. Even when a machine is stored, the batteries should be charged once a month to prevent the batteries from "sulfating". Almost all battery caps are vented, so there's no need to loosen or remove them for charging.
- **Keep the Batteries Clean (Monthly)** - Use a damp cloth to wipe dirt from the top of the batteries. Battery terminals must be clean and tight. If the tops of the batteries are wet after charging, the batteries have probably been over-filled or over-charged. Note: If there is acid on the batteries, wash the tops of the batteries with a solution of baking soda and water (2) tablespoons of baking soda to 1 quart of water.

ELECTRICAL SYSTEM

BATTERY TESTING

A battery problem is usually recognized by the machine operator, as a decrease in the machine's running time. This condition is usually caused by one or more "dead cells" in the battery system- that is, one or more cells that is putting out less voltage than the other cells.

Note: Always charge batteries before testing.

There are 2 ways to find a dead cell:

- Use a hydrometer to check the specific gravity (or "state of charge") of the fluid in each cell. A dead cell is one that reads 50 points (or more) lower than the other cells.
- Use a volt meter to check the voltage of each battery with the scrub and drive motors running. The battery with the dead cell will read 1 or 2 volts lower than the other batteries in the system.

If the batteries in the machine are more than 1 year old, it's usually best to replace the whole set, rather than replacing just one battery.

ACTUATOR DRIVE NUT ADJUSTMENT

This manual section explains the steps for adjusting the drive nut (spring housing) setting for all the models' scrub brush lift actuator motor. Reference the chart below to find the IN & OUT dimensional specification for an actuator motor needing adjustment.

Part #	Actuator Motor	Spring Housing IN Position	Spring Housing OUT Position	Models**
56393303	Scrub Brush Lift	1-3/8" (35mm)*	5-3/8" (136mm)*	A
56393303	Scrub Brush Lift	2-1/4" (57mm)*	5-3/8" (136mm)*	B
56393303	Scrub Brush Lift	7/8" (22mm)*	4-3/8" (111mm)*	C

*The "Spring Housing IN/OUT Position" dimensions are measured when completely assembled. Reference points are the gear box step to the edge of the plastic Spring Housing Guide **(C)** as shown in Figures 3 and 4.

****Model designation:** **(A)**=CMAX 28ST & BA 750ST, **(B)**= CMAX 34ST & BA 850ST, **(C)**=I-MAX 28C, I-MAX 32C & BA 750C

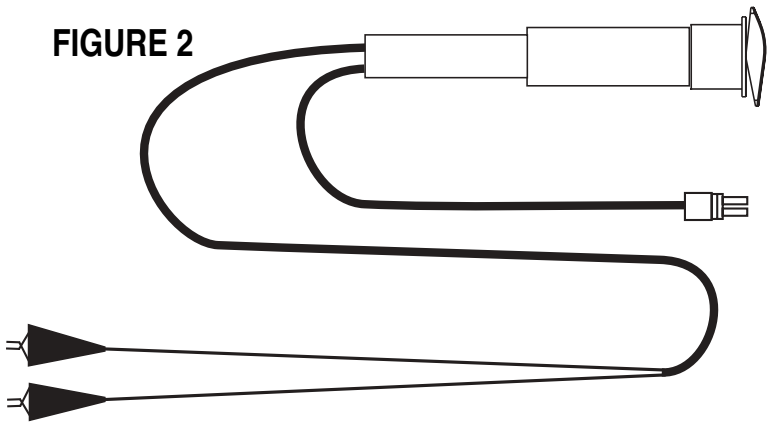
General Instructions for All Actuator Motors

1 See Figure 2. This shows the special actuator power cord adapter **(PN 56407502)** that is needed to connect the machine's battery pack and actuator motor for setting the drive nut limit settings.

2 Open the machine battery compartment and disconnect the battery connector. The battery pack is needed to power the lift actuator motor to properly set the IN & OUT limit switches.

3 Connect the actuator motor to be tested to the power cord adapter end. Then connect the alligator clips from the cord adapter (red clip to the positive and black to negative) to battery connector or battery posts. The rocker switch is used to change the motor rotation in setting the correct drive nut dimension.

FIGURE 2



Instructions for Scrub Brush Lift Actuator Drive Nut Adjustment

1 See Figure 3 and 4. On a new scrub lift actuator motor remove (spin-off) the Drive Nut **(A)** and first slide on the Spring Housing Guide **(C)**, then install the short compression Spring **(D)** onto the actuator (lead screw) shaft. Next reinstall the plastic drive nut as shown (with the nut pin pocket away from the motor). Then finish assembly of remaining parts (long compression spring, Spring Housing **(E)** and mounting hardware).

2 Hold onto the spring housing assembly and press the rocker switch to run the drive motor and retract the spring housing towards the motor housing (its IN limit).

3 Measure the position of the spring housing assembly on the actuator shaft. Manually turn the spring housing assembly to the appropriate IN position shown in the chart above.

4 Hold the spring housing assembly then press the adapter cord rocker switch to run the drive motor to the OUT position (wait until the motor stops).

5 Measure the position of the spring housing assembly on the shaft and compare the measurement with the OUT position shown in the chart.

6 When the measurement doesn't match the dimension shown in the chart it is necessary to remove the Adjuster Cover **(B)** and adjust the OUT position.

Instructions for Scrub Brush Lift Actuator Drive Nut Adjustment (continued)

7 To increase the travel of the spring housing assembly, turn the adjuster clockwise. To decrease the travel of the assembly, turn the adjuster counter clockwise.
NOTE: Use a 5/16" (8mm) wrench to turn the adjuster. Each click of the adjuster will change the spring housing assembly travel 1/16 inch (1.6mm).

8 After each adjustment, hold the spring housing assembly, run the actuator IN & OUT and check both dimensions. After checking that the spring housing limits are set correctly then replace the adjuster cover. **Service Tip Note:** Use the above power cord adapter to help position the spring housing assembly (in or out) for ease in actuator motor installations.

9 After adjusting the actuator spring housing dimensions, follow the Scrub Brush Lift Actuator Removal (Disc or Cylindrical) manual section to reassemble.

Service Tip: See Figure 4. Note the correct orientation of the Spring Housing **(E)** when installing the complete motor assembly and also run the spring housing assembly to the IN (retracted) position for machine installation.

FIGURE 3

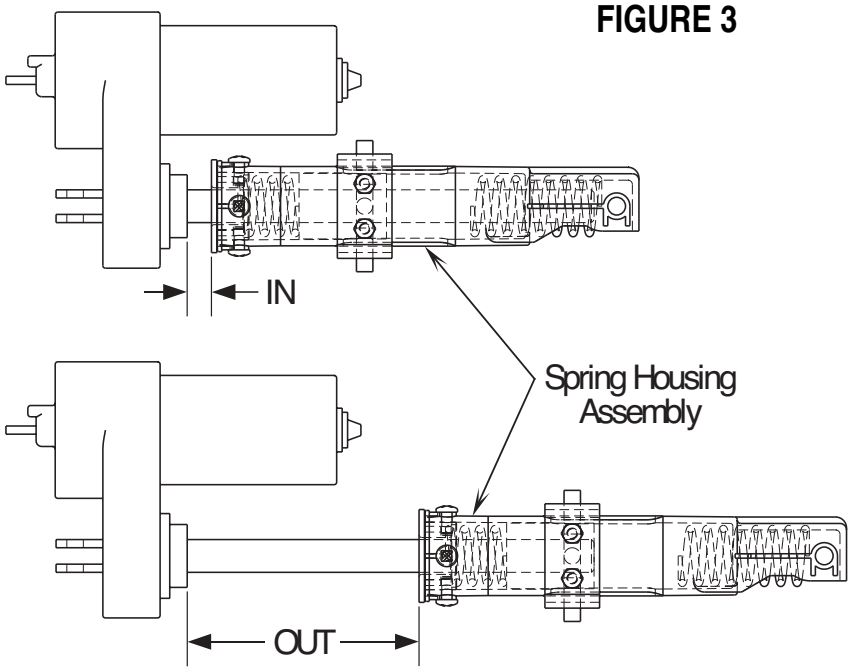
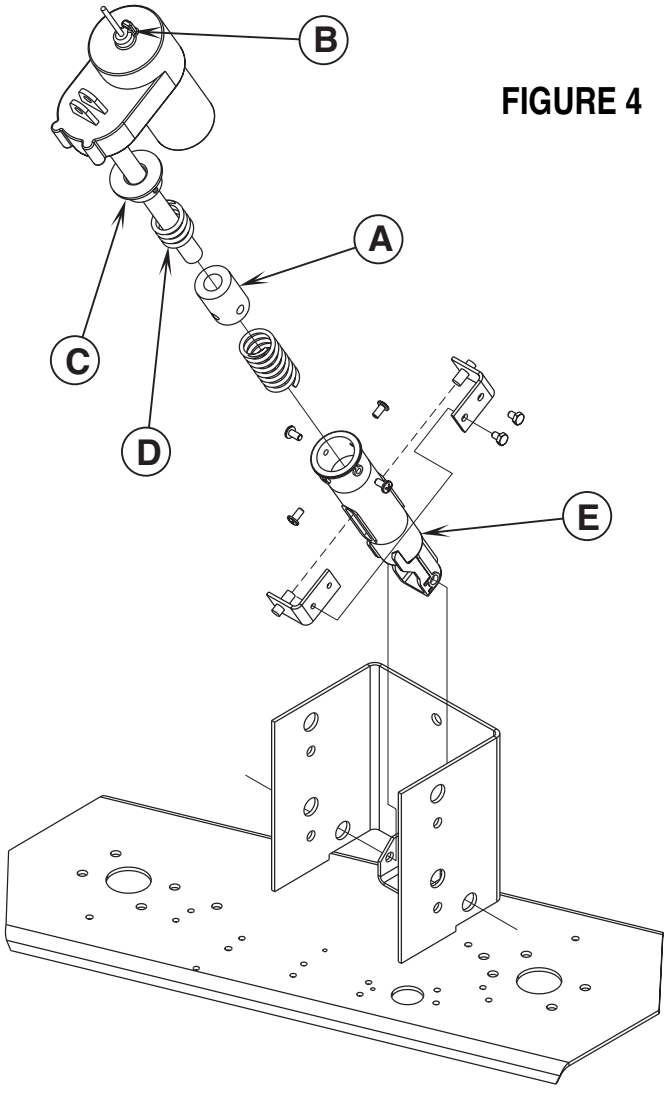


FIGURE 4



ELECTRICAL SYSTEM

FUNCTIONAL OVERVIEW OF MAIN CONTROL BOARD

The primary function of the main control board is to position the scrubbing brushes with respect to the floor surface using a lift actuator motor to maintain the correct brush pressure and current draw of the brush motor. See Figure 5. When the Scrub On/Pressure Increase Button **(G)** is depressed this will lower the scrub deck to the operating position and by pushing or pulling the operator drive paddle start the brush motors. The controller is continuously monitoring the current to the brush motors and when it senses a current draw out of the desired range it automatically raises or lowers the brush deck by turning on the brush actuator motor. This process is repeated until the brush motors are shut off. The controller also manages the other supportive systems such as the solution on/off and vacuum motor. Note: See the Know Your Machine section in this manual for a complete explanation of the machine's operation.

DESCRIPTION OF CONTROL PANEL SYSTEM OVERLOAD INDICATORS

- If the scrub motors or the scrub deck lift actuator become overloaded, the scrub and solution systems will turn off and the scrub-off/pressure-decrease indicator will flash red at a fast rate (four times per second).
- If the vacuum motor becomes overloaded, the scrub, vacuum, and solution systems will turn off and the vacuum indicator will flash yellow at a fast rate (four times per second).
- To reset an overload condition, turn the key switch off and then back on.

Service Note: Read the service test mode instructions (found in this manual section) for additional control panel indicator (light) functions. The service test mode indicator lights are displayed when a service technician enters into this main controller program option to help in electrical troubleshooting.

SERVICE TEST MODE:

The purpose of the service test mode program is to assist the service repairperson with numerous quick short-cut troubleshooting procedures. These test instructions allow for the separate control of each individual electrical system component independent of the normal machine operator inputs.

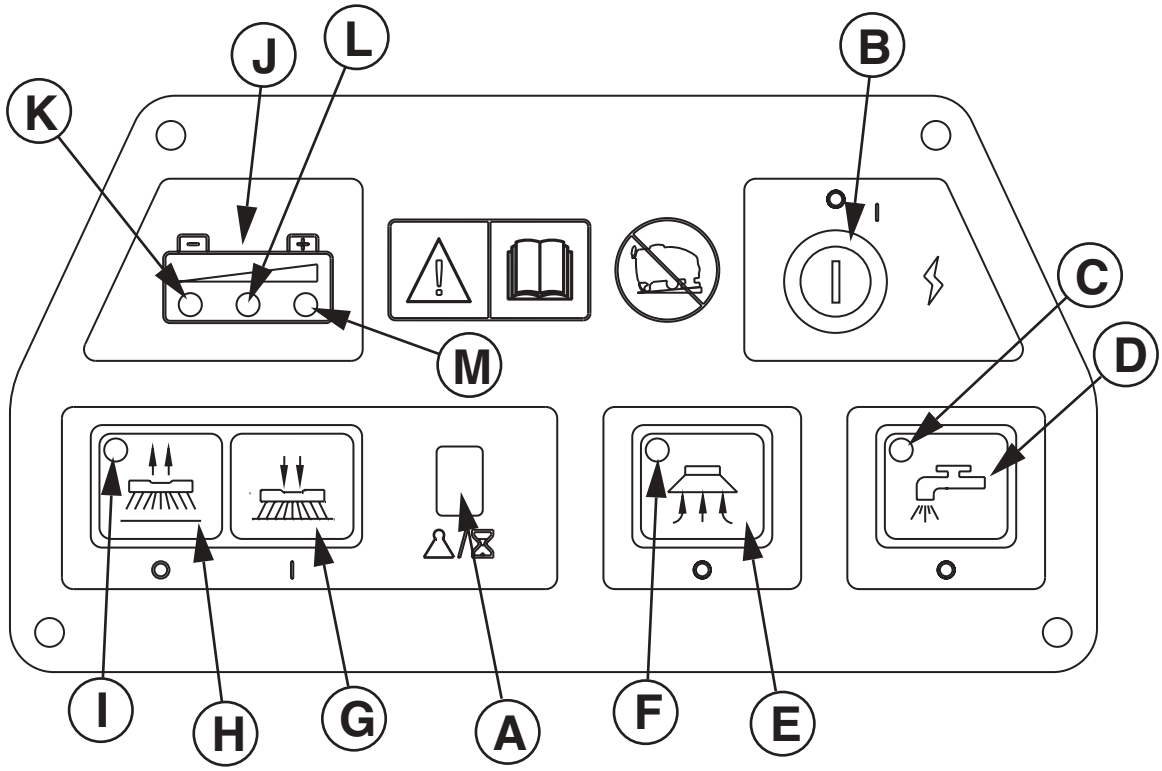
To enter the service test mode perform the following steps:

1 Turn the master on/off key switch to the off position.
2 Press and hold the Scrub Off/Pressure-Decrease and Scrub On/Pressure-Increase buttons (**H & G**).
3 While holding both switches turn the master on/off key switch to the on position.
4 Continue to hold both switches until the hourmeter/status display shows “t”.
5 Release both switches.
6 The function of each switch and indicator is described in the following pages.
7 To exit this mode turn the master on/off key switch to the off position.

CONTROL PANEL

A Scrub Pressure/Hourmeter Display
B Master On/Off Key Switch
C Solution System Indicator
D Solution Button
E Vacuum Button
F Vacuum System Indicator
G Scrub ON / Pressure Increase Button
H Scrub OFF / Pressure Decrease Button
I Scrub OFF Indicator
J Battery Condition Indicator
K Battery Status Red Indicator
L Battery Status Yellow Indicator
M Battery Status Green Indicator

FIGURE 5



ELECTRICAL SYSTEM

SERVICE TEST MODE (CONTINUED)

Main Controller Inputs

See Figure 5 for button locations.

Battery status red indicator (K):

Speed control forward/reverse signal. This is an output from the speed control to the main control unit that indicates when the throttle has been moved from the neutral position either forward or reverse. The red indicator will be lit if this signal is active.

To observe the battery pack voltage value see Status Display (A):

The status display will scroll the battery voltage. This display is accurate to within +/- 0.15 volts. Therefore, the voltage displayed may not correlate precisely to a high-accuracy, calibrated voltmeter. The display format is 2 4 _ 0 (24.0 volts). The digit following the _ character indicates tenths of a volt.

Main Controller Outputs

See Figure 5. The control panel switches are used to control various output functions of the main control unit. Below is a list of each switch and the function it controls. Following the list is a detailed description of each function.

Scrub off/pressure-decrease switch **(H)**: Controls brush motor and optional brush remove relay.
Scrub-on/pressure-increase switch **(G)**: Controls scrub deck lift actuator.
Vacuum switch **(E)**: Controls vacuum.
Solution switch **(D)**: Controls solution solenoid.

Scrub OFF/Pressure-decrease Switch (H):

This switch is used to turn the brush motor on and off as well as turning the remove relay on and off. Upon entering the service test mode, pressing and releasing this switch will alternately turn the brush motor on and off. The indicator **(I)** provides the following status information:
Off - Brush motor output is off and there is no brush motor current flow.
Green - Brush motor output is on and there is normal brush motor current flow.
Flashing green - Either the brush motor output is off and the control is sensing brush motor current flow (control failure, shorted contactor, or wiring problem) or the brush motor output is on and the control is not sensing any brush motor current flow (control failure, open contactor, or wiring problem).

To control the remove relay output, press and release the scrub-off/pressure-decrease switch so that the brush motor is on. Next, press and hold the scrub-off/pressure-decrease switch until the indicator turns red (approximately one second). Pressing and releasing this switch will now alternately turn the remove relay on and off. The indicator provides the following status information:
Off – Remove relay output is off.
Red – Remove relay output is on.

To return to controlling the brush motor output, press and release the scrub-off/pressure-decrease switch so that the remove relay is on. Next, press and hold the scrub-off/pressure-decrease switch until the indicator turns green (approximately one second). Pressing and releasing this switch will now alternately turn the brush motor on and off.

SERVICE TEST MODE (CONTINUED)

Scrub ON/Pressure-increase Switch (G):
This switch is used to control the output to the scrub deck lift actuator. Pressing and releasing this switch will cycle the actuator output through 4 states. These are:
1 - output off, direction = up
2 - output on, direction = down
3 - output off, direction = down
4 - output on, direction = up

When the output is in state 1, the actuator output is turned off. The actuator power indicator (battery yellow) **(L)** should be off and the actuator direction indicator (battery green) **(M)** will be off. If the power indicator is flashing, this indicates that the control is sensing current flow through the actuator (control failure or wiring problem).

When the output is in state 2, the actuator output is turned on. The actuator power indicator (battery yellow) **(L)** should be on or flashing and the actuator direction indicator (battery green) **(M)** will be on. The power indicator will be on steady if the control senses current flow through the actuator. It will flash if no actuator current flow is sensed (actuator at limit, actuator failure, control failure, or wiring problem).

When the output is in state 3, the actuator output is turned off. The actuator power indicator (battery yellow) **(L)** should be off and the actuator direction indicator (battery green) **(M)** will be on. If the power indicator is flashing, this indicates that the control is sensing current flow through the actuator (control failure or wiring problem).

When the output is in state 4, the actuator output is turned on. The actuator power indicator (battery yellow) **(L)** should be on or flashing and the actuator direction indicator (battery green) **(M)** will be off. The power indicator will be on steady if the control senses current flow through the actuator. It will flash if no actuator current flow is sensed (actuator at limit, actuator failure, control failure, or wiring problem).

Vacuum Switch (E):
This switch is used to turn the vacuum motor on and off. Pressing and releasing this switch will alternately turn the vacuum motor on and off. The indicator **(F)** provides the following status information:
Off - Vacuum output is off and there is no vacuum motor current flow.
Green - Vacuum output is on and there is normal vacuum motor current flow.
Flashing green - Either the vacuum motor output is off and the control is sensing vacuum motor current flow (control failure, shorted contactor, or wiring problem) or the vacuum motor output is on and the control is not sensing any vacuum motor current flow (open contactor, control failure, or wiring problem).

Solution Switch (D):
This switch is used to turn the solution solenoid on and off. Pressing and releasing this switch will alternately turn the solution solenoid on and off. The indicator **(C)** provides the following status information:
Off - Solenoid output is off.
Green - Solenoid output is on.

ELECTRICAL SYSTEM

MAIN CONTROL BOARD SPECIAL PROGRAM OPTIONS

Recall Display of the Main Control Board Software Revision Level:

If it is desired to recall the machine's (A1) main control board software level perform the following steps:

1 Turn the master on/off key switch to the off position.
2 Press and hold the scrub off/pressure-decrease and solution switches.
3 While holding both switches turn the master on/off key switch to the on position.
4 Continue to hold both switches until the hourmeter/status display shows a letter of the alphabet (example "b") then release both switches.
5 The letter displayed "b" represents to the service mechanic the control board's revision level.
6 Exit by turning the key switch to the off position.

Selection of Low Voltage Cutout Threshold:

FACTORY DEFAULT: Standard

The low voltage cutout feature will prevent over-discharging the batteries. This feature will automatically shut down the scrub system when the battery voltage falls to the selected threshold. The cutout level is adjustable. The standard setting is 1.72 volts per cell and the alternate setting is 1.81 volts per cell. The standard setting should be used unless the battery manufacturer specifies the higher cutout voltage. It is important to note that some maintenance free batteries (including some gelled electrolyte cells) are capable of being safely discharged down to 1.72 volts per cell. To select between the two types:

1 Turn the master on/off key switch to the off position.
2 Press and hold the scrub off switch.
3 While holding the scrub off switch turn the master on/off key switch to the on position.
4 Continue to hold the scrub off switch until the scrub off indicator turns green and the hourmeter/status display shows "S" (standard) or "A" (alternate).
5 Release the scrub off switch.
6 Pressing and releasing the scrub off switch will now select between the two options. For standard wet cell batteries select "S" and for batteries that require the higher cutout voltage select "A".
7 To save the new setting, turn the master on/off key switch to the off position.
8 The new setting will be saved and will remain in effect until it is changed again.

Adjustment of Scrub Pressure Limit:

FACTORY DEFAULT: 9 (MAXIMUM)

The maximum scrub pressure setting is adjustable so that the scrub pressure can be limited to the desired level. The limit can be set anywhere from 1 (minimum pressure) to 9 (maximum pressure). To adjust the scrub pressure limit:

1 Turn the master on/off key switch to the off position.
2 Press and hold the scrub-on/pressure-increase switch.
3 While holding the scrub-on/pressure-increase switch turn the master on/off key switch to the on position.
4 Continue to hold the scrub-on/pressure-increase switch until the hourmeter/status display shows a number from 1 to 9 (approximately 3 seconds).
5 Release the scrub-on/pressure-increase switch.
6 Pressing and releasing the scrub-on/pressure-increase switch will now increment the limit setting to a maximum of 9. Once 9 is reached, the limit will roll-over to 1.
7 To save the new setting, turn the master on/off key switch to the off position.
8 The new setting will be saved and will remain in effect until it is changed again.

CURRENT DRAW OF SCRUB BRUSH MOTORS

Model designation: (**A**)=CMAX 28ST & BA 750ST, (**B**)=BA 850ST, (**C**)=I-MAX 28C & BA 750C, (**D**)=I-MAX 32C, (**E**)=CMAX 34ST

24V*		
PA#	3/4 HP Models A & B	
1	22A	
2	25A	
3	28A	
4	31A	
5	34A	
6	38A	
7	44A	
8	51A	
9	60A	

36V*		
PA#	3/4 HP Models C & D	3/4 HP Model E
1	18A	17A
2	20A	19A
3	22A	21A
4	24A	23A
5	26A	25A
6	28A	27A
7	30A	31A
8	32A	35A
9	34A	39A

* Values given are approximate.

Restoring the Scrub Pressure Limit to Default:

FACTORY DEFAULT: 9 (MAXIMUM)

If it is desired to restore the scrub pressure setting back to the factory default, perform the following steps:

1 Turn the master on/off key switch to the off position.
2 Press and hold the scrub-on/pressure-increase and vacuum switches.
3 While holding both switches turn the master on/off key switch to the on position.
4 Continue to hold both switches until the hourmeter/status display shows “d”
5 Release both switches.
6 The scrub pressure limit has now been restored.
7 Turn the master on/off key switch to the off position.

ELECTRICAL SYSTEM

SPECIAL PROGRAM OPTIONS (CONTINUED)

Enabling or Disabling the Vacuum Automatic Shutoff Option:

FACTORY DEFAULT: ENABLED

To indicate to the operator that the recovery tank is full, the control system will automatically turn off the vacuum and display “FULL” on the hourmeter/status display if the recovery tank becomes filled. If problems are encountered with the vacuum automatic shutoff feature, such as the vacuum shutting off even if the recovery tank is not full, this feature can be disabled. To enable or disable this feature perform the following steps:

1 Turn the master on/off key switch to the off position.
2 Press and hold the vacuum switch.
3 While holding the vacuum switch turn the master on/off key switch to the on position.
4 Continue to hold the vacuum switch until the hourmeter/status display shows “d” (disabled) or “E” (enabled) and the vacuum indicator is green.
5 Release the vacuum switch.
6 Pressing and releasing the vacuum switch will now select between “E” (enabled) or “d” (disabled).
7 To save the new setting, turn the master on/off key switch to the off position.
8 The new setting will be saved and will remain in effect until it is changed again.

Brush Type Selection:

FACTORY DEFAULT: Dependent on machine model

To operate properly and avoid potential damage to the electrical system, the control must be programmed for the type of scrub deck installed on the machine. There are three possible types. One uses cylindrical brushes and the other two use disc type brushes and pads. This function configures the control unit current settings for each of the scrub deck types. To select the proper type:

1 Turn the master on/off key switch to the off position.
2 Press and hold the solution switch.
3 While holding the solution switch, turn the master on/off key switch to the on position.
4 Continue to hold the solution switch until the solution indicator turns green and the hourmeter/status display shows “d”, “C” or “1”.
5 Release the solution switch.
6 Pressing and releasing the solution switch will now select between the three options. For the cylindrical brush unit select “C”, for the 3/4 HP disc type units (24V & 36V) select “d”. Note: The third displayed selection “1” is not to be used, it is programmed for possible future engineering use. If “1” is selected electrical overload damage to the brush motors could result (which also would void the warranty).
7 To save the new setting, turn the master on/off key switch to the off position.
8 The new setting will be saved and will remain in effect until it is changed again.

⚠ CAUTION!

Improperly setting this parameter can result in serious damage to the machine. If this is set for 1 HP motors with 3/4 HP motors installed on the machine, the motors may be overloaded which can cause overheating and permanent damage to the motors. It could also create a fire hazard.

Enabling/Disabling the Optional Brush Remove Feature:

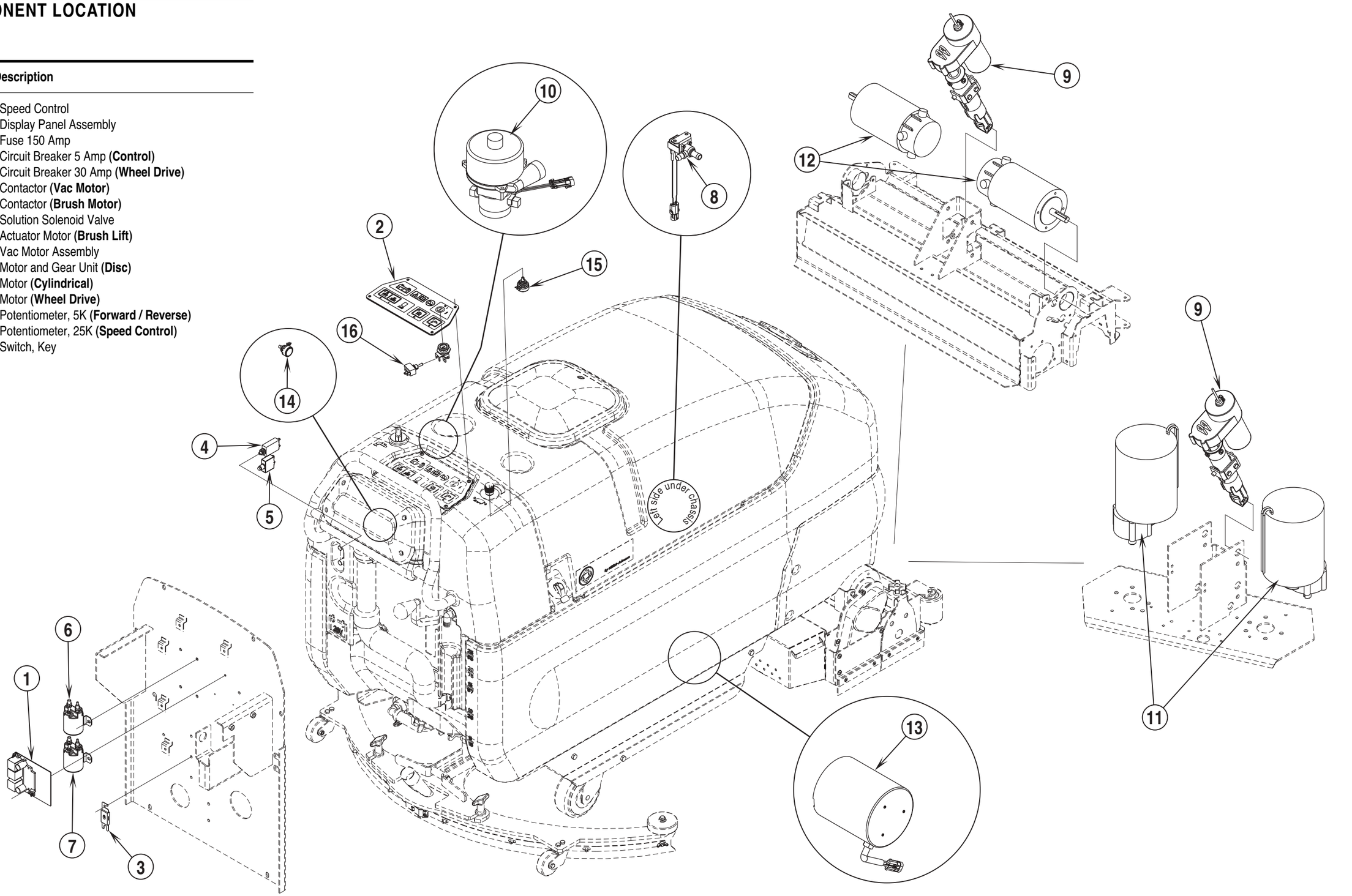
FACTORY DEFAULT: DISABLED

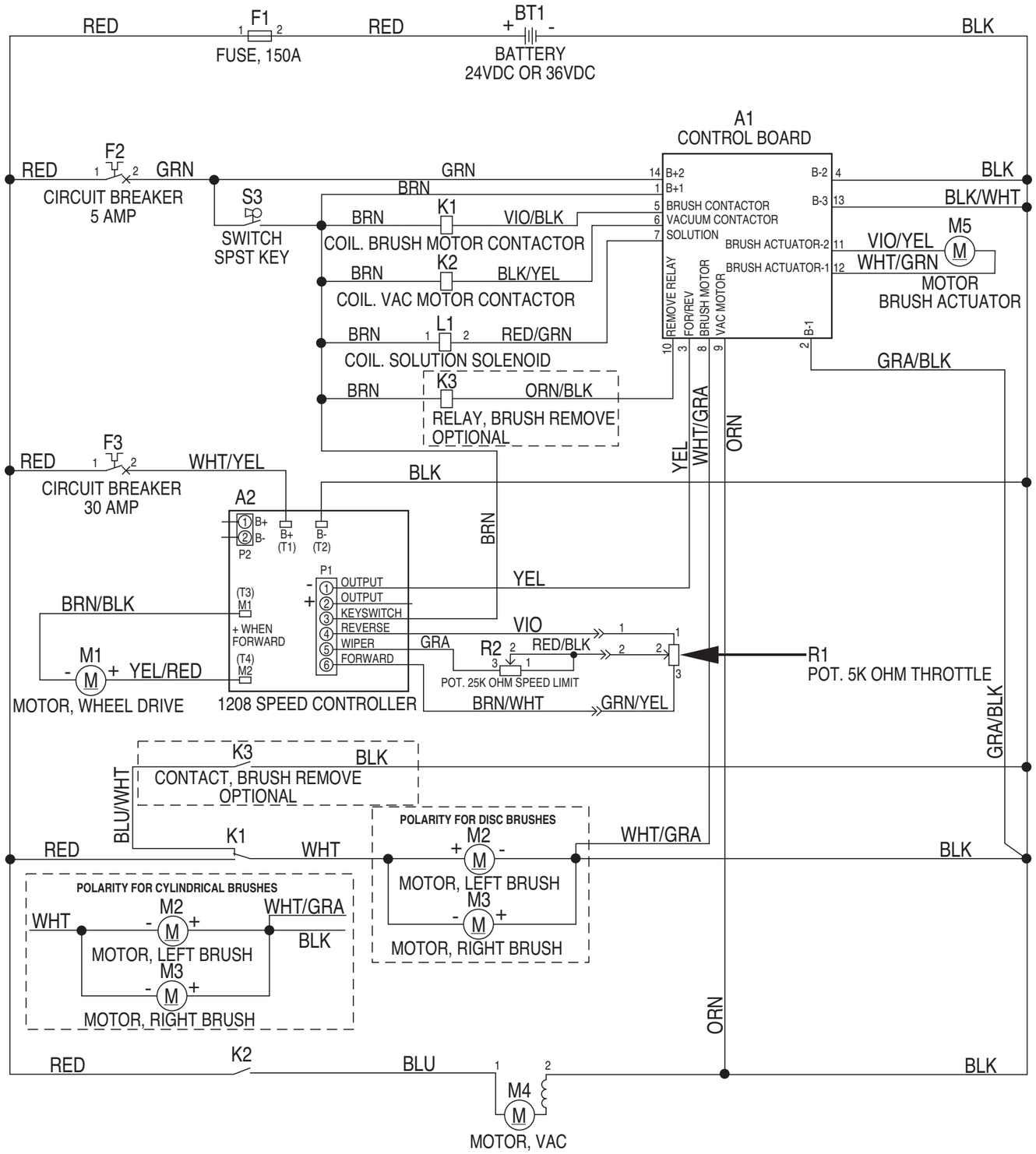
With the installation of the optional remove relay kit, disc type machines can be configured for automatic brush removal. The automatic remove functions are disabled at the factory. If it is desired to enable this feature perform the following steps:

1 Turn the master on/off key switch to the off position.
2 Press and hold the scrub-off/pressure-decrease and vacuum switches.
3 While holding both switches turn the master on/off key switch to the on position.
4 Continue to hold both switches until the hourmeter/status display shows “E” or “d” and the vacuum indicator turns red.
5 Release both switches.
6 Press and release the vacuum switch to select “E” (enabled) or “d” (disabled).
7 Turn the master on/off key switch to the off position.

COMPONENT LOCATION

Item	Description
1	Speed Control
2	Display Panel Assembly
3	Fuse 150 Amp
4	Circuit Breaker 5 Amp **(Control)**
5	Circuit Breaker 30 Amp **(Wheel Drive)**
6	Contactor **(Vac Motor)**
7	Contactor **(Brush Motor)**
8	Solution Solenoid Valve
9	Actuator Motor **(Brush Lift)**
10	Vac Motor Assembly
11	Motor and Gear Unit **(Disc)**
12	Motor **(Cylindrical)**
13	Motor **(Wheel Drive)**
14	Potentiometer, 5K **(Forward / Reverse)**
15	Potentiometer, 25K **(Speed Control)**
16	Switch, Key



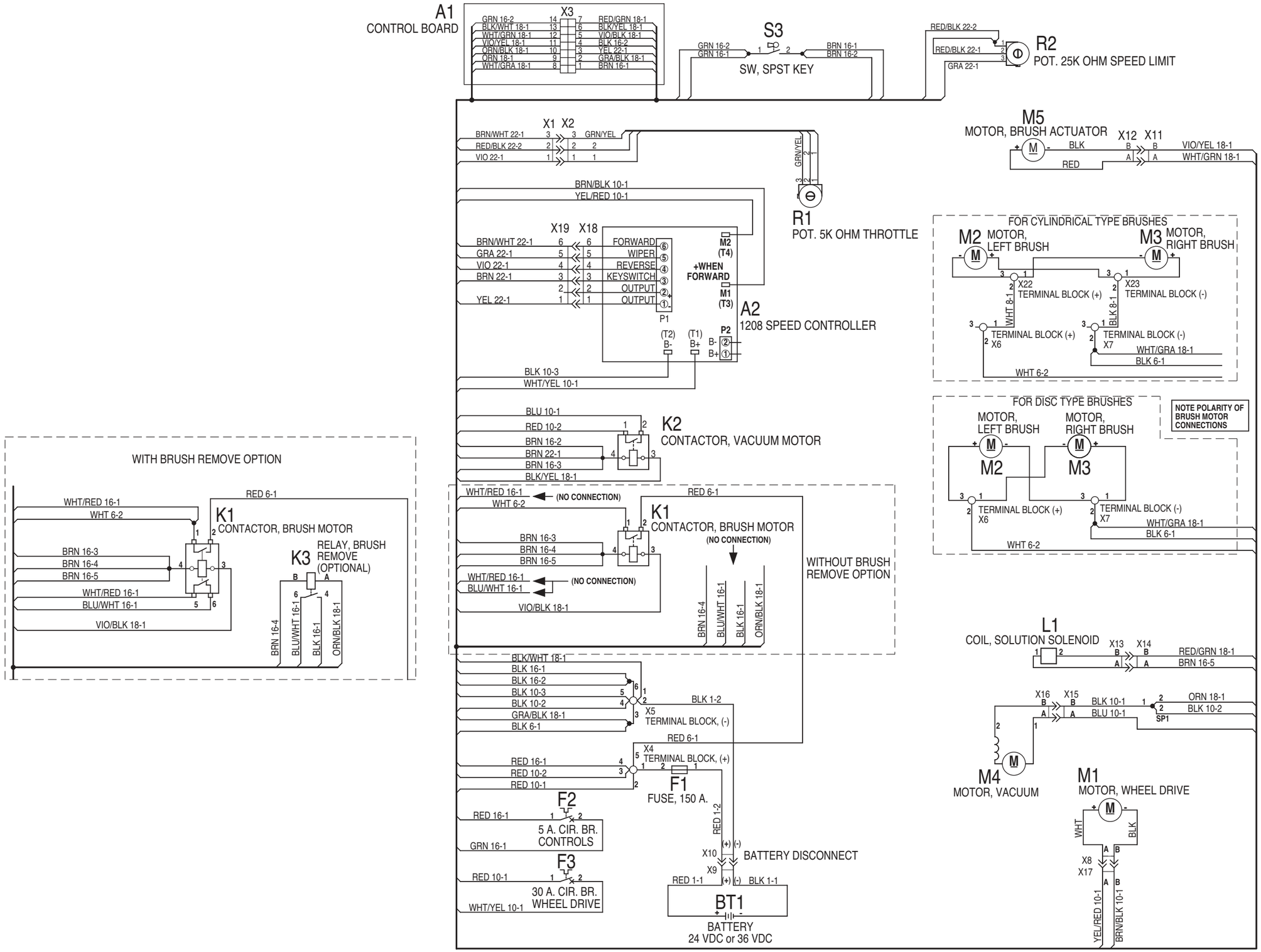


WIRING DIAGRAM / SCHEMATIC

Item	Description
A1	Control PCB Assy
A2	Control, DC Curtis
BT	Batteries*
F1	Fuse, 150 Amp
F2	Circuit Breaker 5 Amp **(Control Circuit)**
F3	Circuit Breaker 30 Amp **(Wheel Drive)**
K1	Contactor, **(Brush Motor)** (Standard-SPST / Option-SPDT)
K2	Contactor, **(Vac Motor)** (SPST)
K3	Relay, **(Brush Remove/Optional)**
L1	Solution Solenoid Valve
M1	Motor **(Wheel Drive)**
M2	Motor **(Left Brush)**
M3	Motor **(Right Brush)**
M4	Motor **(Vacuum)**
M5	Actuator, Motor **(Brush Lift)**
R1	Potentiometer, 5K **(Forward-Reverse / Throttle)**
R2	Potentiometer, 25K **(Speed Limit)**
S3	Switch, Key **(Main Power)**

A1 Control Board Pin Detail

Pin #	Wire Color	Controller Pin Description & Function
1	Brn	Battery (+) key switch input (KSI) powers up controller.
2	Gra/Blk	Battery ground input (-) to controller.
3	Yel	A2 speed control auxiliary driver input (-) activates all auto scrub functions.
4	Blk	Battery ground (-) circuit input for all solenoid coils.
5	Vio/Blk	Controller (-) circuit output to the K1 brush motor solenoid.
6	Blk/Yel	Controller (-) circuit output to the K2 Vacuum motor solenoid.
7	Red/Grn	Controller (-) circuit output to the L1 solution solenoid.
8	Wht/Gra	Brush motor current sense wire (+) shunt circuit input to controller.
9	Orn	Vacuum motor current sense wire (+) shunt circuit input to controller.
10	Orn/Blk	Controller (-) circuit output to the K3 brush remove solenoid (Opt).
11	Vio/Yel	Polarity reversing (+ or -) circuit output from the controller to the brush lift actuator motor.
12	Wht/Grn	Polarity reversing (+ or -) circuit output from the controller to the brush lift actuator motor.
13	Blk/Wht	Battery ground (-) circuit input for brush lift actuator motor.
14	Grn	Battery (+) circuit input for brush lift actuator motor.


A1
CONTROL BOARD
X3
GRN 16-2
BLK/WHT 18-1
WHT/GRN 18-1
VIO/YEL 18-1
ORN/BLK 18-1
ORN 18-1
WHT/GRA 18-1
RED/GRN 18-1
BLK/YEL 18-1
VIO/BLK 18-1
BLK 16-2
YEL 22-1
GRA/BLK 18-1
BRN 16-1
S3
SW, SPST KEY
GRN 16-2
GRN 16-1
BRN 16-1
BRN 16-2
R2
POT. 25K OHM SPEED LIMIT
RED/BLK 22-2
RED/BLK 22-1
GRA 22-1
M5
MOTOR, BRUSH ACTUATOR
BLK
RED
X12
X11
VIO/YEL 18-1
WHT/GRN 18-1
X1
X2
BRN/WHT 22-1
RED/BLK 22-2
VIO 22-1
GRN/YEL
R1
POT. 5K OHM THROTTLE
BRN/BLK 10-1
YEL/RED 10-1
X19
X18
FORWARD
WIPER
REVERSE
KEYSWITCH
OUTPUT
OUTPUT
P1
M2
(T4)
+WHEN
FORWARD
M1
(T3)
A2
1208 SPEED CONTROLLER
(T2)
B-
(T1)
B+
P2
BLK 10-3
WHT/YEL 10-1
FOR CYLINDRICAL TYPE BRUSHES
M2 MOTOR,
LEFT BRUSH
M3 MOTOR,
RIGHT BRUSH
X22
TERMINAL BLOCK (+)
X23
TERMINAL BLOCK (-)
WHT 8-1
BLK 8-1
TERMINAL BLOCK (+)
X6
TERMINAL BLOCK (-)
X7
WHT/GRA 18-1
BLK 6-1
WHT 6-2
FOR DISC TYPE BRUSHES
MOTOR,
LEFT BRUSH
MOTOR,
RIGHT BRUSH
M2
M3
TERMINAL BLOCK (+)
X6
TERMINAL BLOCK (-)
X7
WHT/GRA 18-1
BLK 6-1
WHT 6-2
NOTE POLARITY OF
BRUSH MOTOR
CONNECTIONS
BLU 10-1
RED 10-2
BRN 16-2
BRN 22-1
BRN 16-3
BLK/YEL 18-1
K2
CONTACTOR, VACUUM MOTOR
WITH BRUSH REMOVE OPTION
WHT/RED 16-1
WHT 6-2
RED 6-1
K1
CONTACTOR, BRUSH MOTOR
BRN 16-3
BRN 16-4
BRN 16-5
WHT/RED 16-1
BLU/WHT 16-1
VIO/BLK 18-1
K3
RELAY, BRUSH
REMOVE
(OPTIONAL)
BRN 16-4
BLU/WHT 16-1
BLK 16-1
ORN/BLK 18-1
(NO CONNECTION)
WITHOUT BRUSH
REMOVE OPTION
BLK/WHT 18-1
BLK 16-1
BLK 16-2
BLK 10-3
BLK 10-2
GRA/BLK 18-1
BLK 6-1
BLK 1-2
X5
TERMINAL BLOCK, (-)
X4
TERMINAL BLOCK, (+)
RED 16-1
RED 10-2
RED 10-1
F1
FUSE, 150 A.
F2
5 A. CIR. BR.
CONTROLS
GRN 16-1
F3
30 A. CIR. BR.
WHEEL DRIVE
RED 10-1
WHT/YEL 10-1
RED 1-2
X10
X9
BATTERY DISCONNECT
RED 1-1
BLK 1-1
BT1
BATTERY
24 VDC or 36 VDC
L1
COIL, SOLUTION SOLENOID
X13
X14
RED/GRN 18-1
BRN 16-5
X16
X15
BLK 10-1
BLU 10-1
ORN 18-1
BLK 10-2
SP1
M4
MOTOR, VACUUM
M1
MOTOR, WHEEL DRIVE
WHT
BLK
X8
X17
YEL/RED 10-1
BRN/BLK 10-1

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